PART II - ENVIRONMENTAL AND LEGAL ISSUES

A. APPROACH

Hawaiian Electric Company's Integrated Resource Plan (IRP)(1) contained reconnaissance level descriptions of the major project components, performance estimates, cost estimates, potential environmental impacts, and objective characterizations for a pumped storage hydroelectric (PSH) facility located either at Koko Crater or Kaau Crater on Oahu. The IRP stated that should the pumped storage option appear favorable, the next step in the assessment process would be a pre-feasibility study. Such a study would give a more specific indication of the technical feasibility of the sites, potential environmental impacts, and mitigations. A pre-feasibility study usually involves the acquisition of basic environmental data specific to the site through field inspections.

The environmental data and other legal considerations summarized herein are based on reviews of other pertinent studies, interviews with agency personnel and citizens' group representatives, and limited field reconnaissance of both potential sites. Specialists in flora, fauna, and archaeology visited each site, and their respective reports may be found in Appendices A through D.

The environmental baseline information and impact analyses provided herein are similar to the contents of a formal environmental assessment (EA) as described in Chapter 343, Hawaii Revised Statutes (Hawaii's Environmental Impact Statement (EIS) Law) and Chapter 200, Hawaii Administrative Rules (Hawaii's EIS Rules); however, not all of the requirements are met. The scope of this report was limited with the intent of selecting the more feasible of the two sites before a full environmental assessment was made. Should either of the two potential sites be selected for further work, a formal EA, and likely an EIS, would be required.

Sections II-B and II-C respectively describe the site characteristics, ownership, land use and permitting requirements for the Koko Crater and the Kaau Crater/Maunawili PSH projects. Sections II-D and II-E discuss conclusions regarding the feasibility of each project and recommendations for follow on work.

B. KOKO CRATER PROJECT

1. Landside Facilities

a. General Site Characteristics

Koko Crater is located on the southeastern portion of the island of Oahu, in the Honolulu Judicial District. The crater, rising to about 1,200 feet above sea level, is horseshoe-shaped, opening to the northeast. The crater is a compound tuff cone formed by volcanic eruptions along the Koko fissure two million years or more after the principal volcanic activity which built the Koolau Shield Volcano. It is the highest, best preserved and probably most recently formed tuff cone on Oahu.(2) (Appendix E provides detail on the crater's geological features)

Koko Crater is separated from the ocean by Kalanianaole Highway and extends from Koko Head to Sandy Beach. The interior of the crater contains a 200-acre botanical garden and a riding stable at its opening. The botanical garden includes a wide variety of cacti, plumeria, and other plants. A portion of the Hawaii Kai Golf Course is located on the north side of the crater. The crater is part of the Koko Head Park.(3)

Koko Head Park, administered by the City and County of Honolulu Department of Parks and Recreation, was established in 1928, and is the largest City-owned park on Oahu. The park area consists of 19 separate parcels of land totaling 1,275 acres. With the exception of three parcels totalling about one acre in area owned by Hawaiian Telephone Company, the land is owned by the City and County of Honolulu. The land

was acquired by the City from the Estate of Bernice Pauahi Bishop, with a deed restriction that use of the area be limited to public parks or rights-of-way. According to the deed, any non-recreational activities in the park must be approved by the Bishop Estate Trustees.(4) Figure II-1 shows the ownership of parcels within and surrounding the Koko Crater project site.

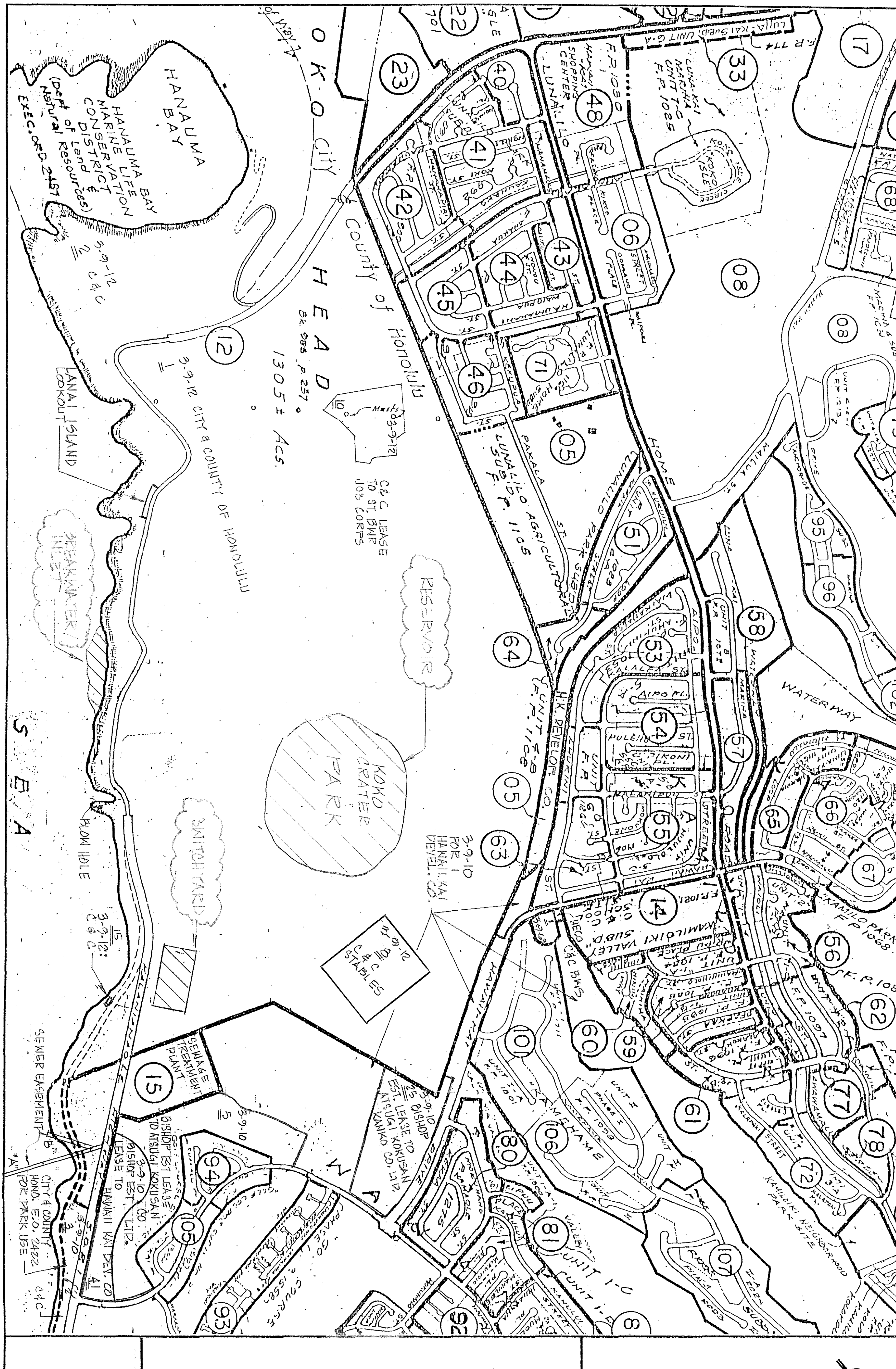
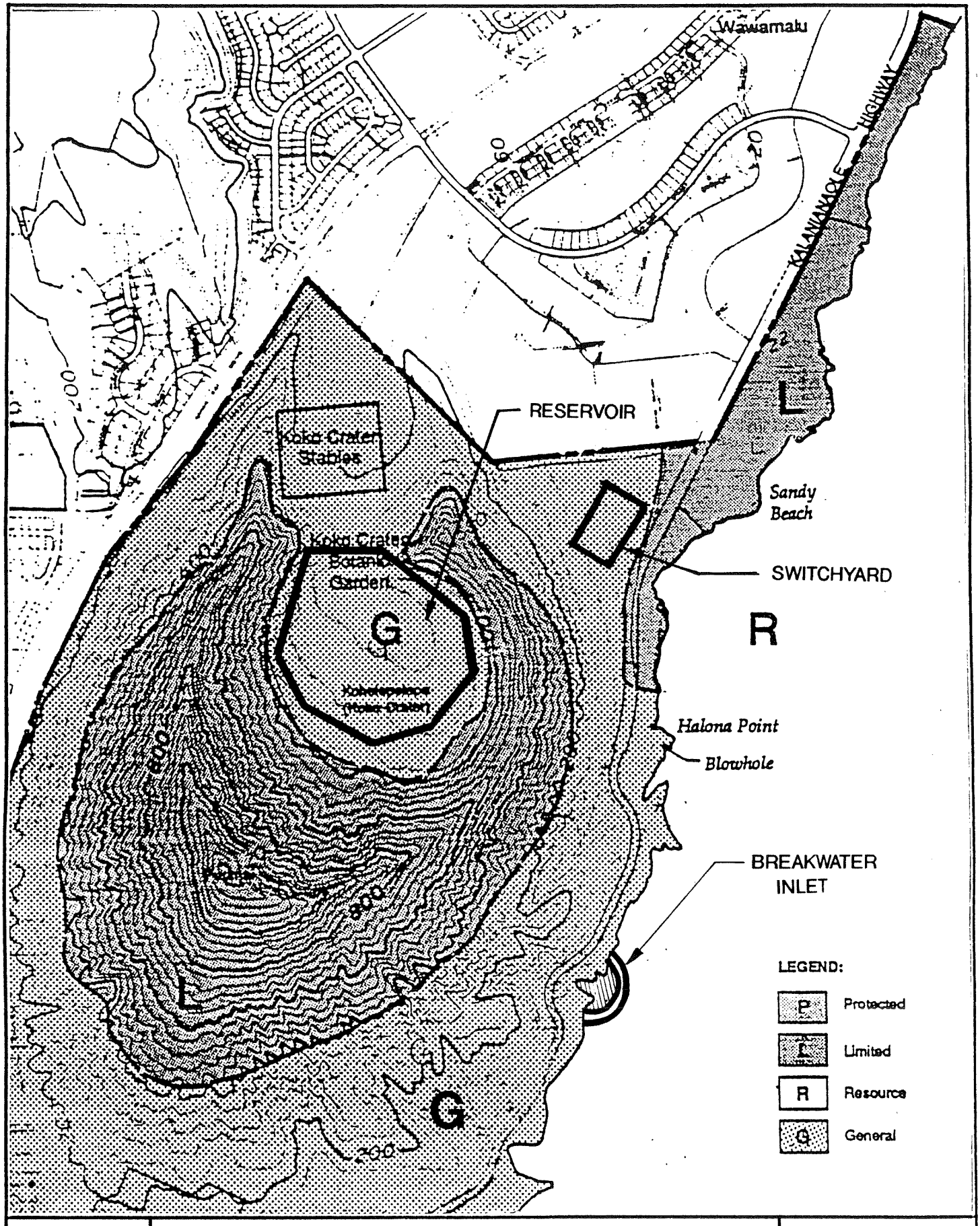


FIGURE II-1	**KOKO CRATER PSH PROJECT** **LAND OWNERSHIP**	

Landside facilities associated with the PSH project would include an upper reservoir (Koko Crater), an access road into the mouth of the crater, tunnels through the crater to a combined, below-grade pump-house generating station, and electrical transmission lines and switchyard. All but the transmission line would be situated on City lands. The conceptual plans call for the electrical switching station to be located adjacent to the existing Hawaii Kai Sewage Treatment Plant on lands within Koko Crater Park. Routing the transmission lines will likely involve both public and private land easements. The shoreline breakwater/inlet is discussed in Section II-B.2.

Koko Head Park and the adjacent nearshore waters are within the State Conservation District. Surrounding lands, including the potential switchyard site, are designated Urban. The State Conservation District is divided into subzones according to the degree of protection accorded specific areas. Figure II-2 shows the Conservation District subzones in the project area. The floor of the crater and lands from the shoreline to about the 400-foot elevation are in the General subzone. The objective of this subzone is to designate open space where specific conservation uses may not be defined, but where urban use would be premature. A specifically permitted use in this subzone is development of water collection, pumping, storage, control, and transmission; however, application of this permission to a pumped storage hydroelectric facility may exceed the intent of the permitted use.

Waters offshore of Koko Crater are in the Resource subzone. The objective of this subzone is to develop, with proper management, areas to ensure sustained use of the natural resources of those areas. The slopes of Koko Crater above about the 400-foot elevation are in the Limited subzone. The objective of this subzone is to limit uses where natural conditions suggest constraints on human activities. In any subzone, governmental use is permitted where public benefit outweighs any impact on the conservation district. Generally, a utility use may be considered governmental use, but a formal environmental assessment (and likely an EIS) would be required to assess the relative benefits and impacts of the PSH project.



KOKO CRATER PUMPED STORAGE HYDROELECTRIC PROJECT

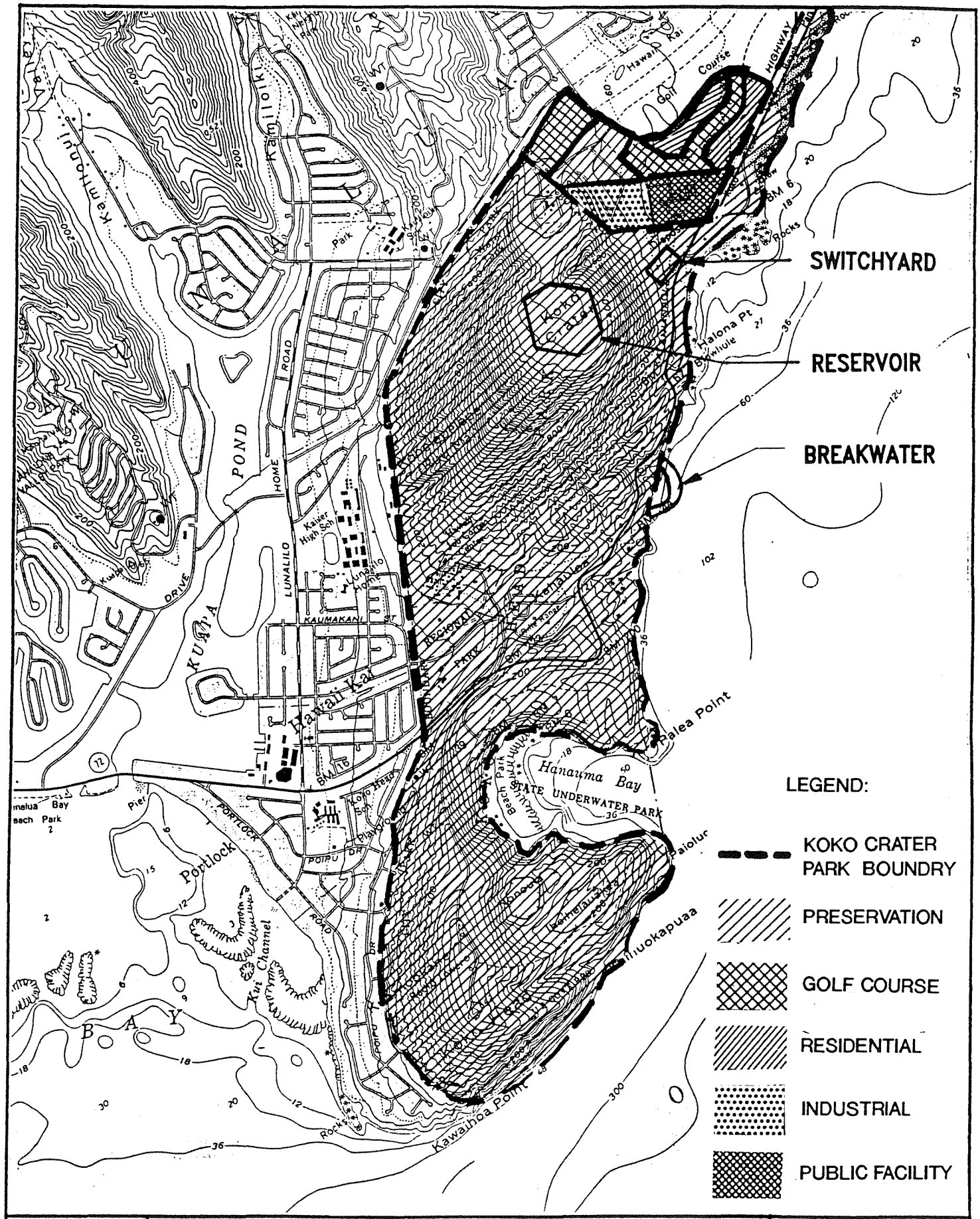
STATE LAND USE SUBZONES

FIGURE II-2

At the City level, future land uses are guided by the Development Plan. Koko Head Park is located in the East Honolulu Development Plan area. The entire park is designated as Preservation on the Development Plan's land use map. This designation is consistent with the State designation of the area as Conservation.(4) Figure II-3 indicates the East Honolulu Development Plan land use for the project area. The Sewage Treatment Plant site is designated Public Facility. Mauka of that is a parcel designated Industrial, where the proposed switching station could alternatively be located. The East Honolulu Public Facilities Map shows development of a solid waste transfer station in this area and improvements to the Koko Crater Botanic Garden.

Special Provisions of the East Honolulu Development Plan relating to urban design considerations specify that high priority shall be given to visibility, preservation, enhancement and accessibility of open space in the design of developments near Koko Crater.

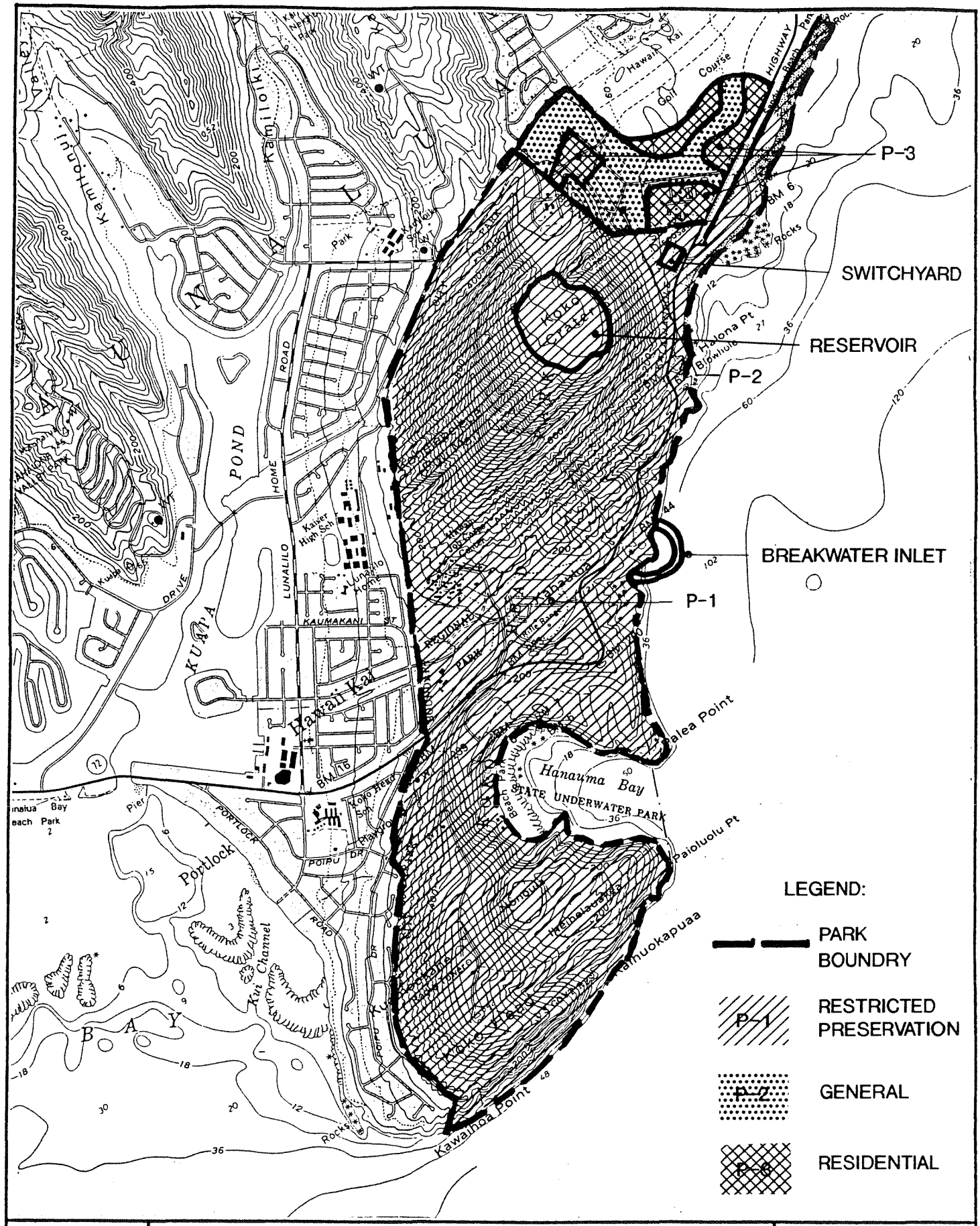
Specific land use zoning and development controls for all property on the Island of Oahu are established in the City & County Land Use Ordinance (LUO).(5) Eleven zoning categories are identified in the LUO: Preservation, Agricultural, Country, Residential, Apartment, Apartment Mixed Use, Resort, Business, Business Mixed Use, Industrial, and Industrial-Commercial Mixed Use. Most of these classifications are further broken down into specific zoning designations which dictate both density and use. Figure II-4 shows the zoning designations in the project area. Koko Head Park is zoned P-1 Restricted Preservation, one of three possible designations under the Preservation Classification. According to Section 5.10 of the LUO, "It is intended that all lands within a State-designated Conservation District be zoned P-1 Restricted Preservation District." Section 5.10-1 establishes the Uses and Development Standards for the three Preservation Zoning Districts. It states, in part, "Within the P-1 Restricted Preservation District, all uses, structures and development standards shall be governed by the appropriate State agencies." It is, therefore, important to note that while Koko Head Park is zoned by the City and County of Honolulu, and regulated by the City's East Honolulu



KOKO CRATER PUMPED STORAGE HYDROELECTRIC PROJECT

EAST HONOLULU DEVELOPMENT PLAN

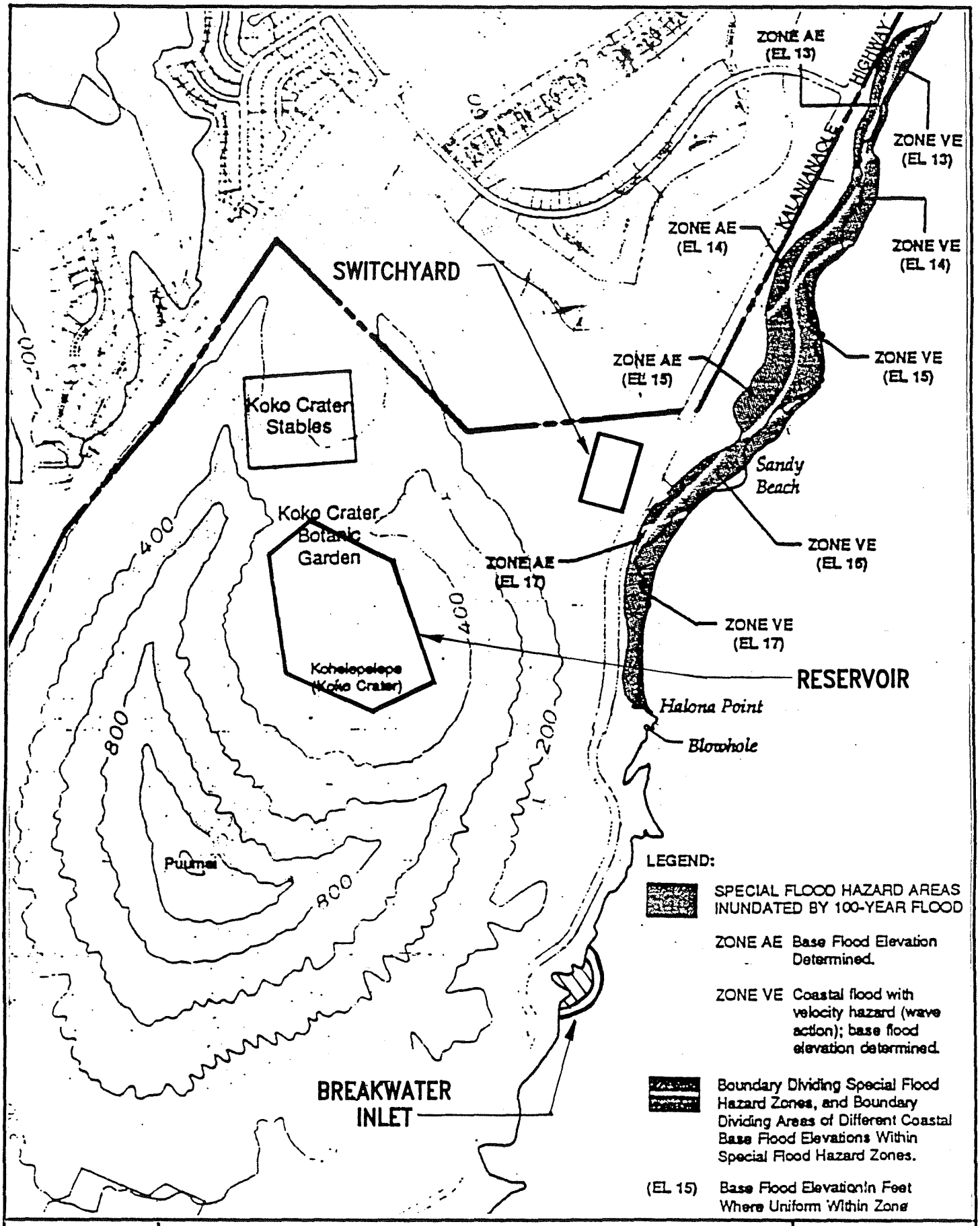
FIGURE II-3



KOKO CRATER PUMPED STORAGE HYDROELECTRIC PROJECT

EXISTING ZONING

FIGURE II-4



KOKO CRATER PUMPED STORAGE HYDROELECTRIC PROJECT

FLOOD ZONES

FIGURE II-5

Development Plan, the actual control over uses, structures and development standards lies with the State's Department of Land and Natural Resources through the vehicle of a Conservation District Use Permit. Thus, although the City establishes regulations over such matters as uses and height limits in Preservation Districts, in those districts zoned P-1 (such as Koko Head Park), it has no authority to enforce its regulations. Enforcement is left to the Department of Land and Natural Resources. The City is traditionally consulted on all Conservation District Use Applications which are submitted to the DLNR, however, the DLNR is under no obligation to act on City recommendations or enforce City policy.(4)

As a consequence of enactment of the U.S. National Flood Insurance Act of 1968 (Public Laws 90-448 and 91-152), as amended, and the U.S. Flood Disaster Protection Act of 1973 (Public Law 93-234), as amended, the LUO contains restrictions on development within flood hazard zones. Figure II-5 shows the flood hazard designations in the area as delineated on the Flood Insurance Rate Maps prepared by the Federal Insurance Administration, Federal Emergency Management Agency. The majority of the park property has been designated Zone D, areas in which flood hazards are undetermined. A small portion of the park along the shoreline from about Halona Point to Sandy Beach is subject to tsunami flooding. These areas are designated Zones AE (base flood elevations determined) and VE (coastal flood with velocity hazard (wave action) and base flood elevations determined). The smaller portion is also within the 100-year flood zone and has a velocity (wave action) ranging from 22 to 25 feet. Base flood elevations along this stretch of land range from 13 to 17 feet above mean sea level. According to the Atlas of Hawaii, the 1946 tsunami reached heights up to 31 feet along the coastline near Sandy Beach.(6) None of the proposed PSH facilities would encroach into designated flood zones.

For emergency evacuation purposes, however, the City and County of Honolulu, Civil Defense Agency designates a tsunami inundation area from Koko Head to Makapuu Point as follows:

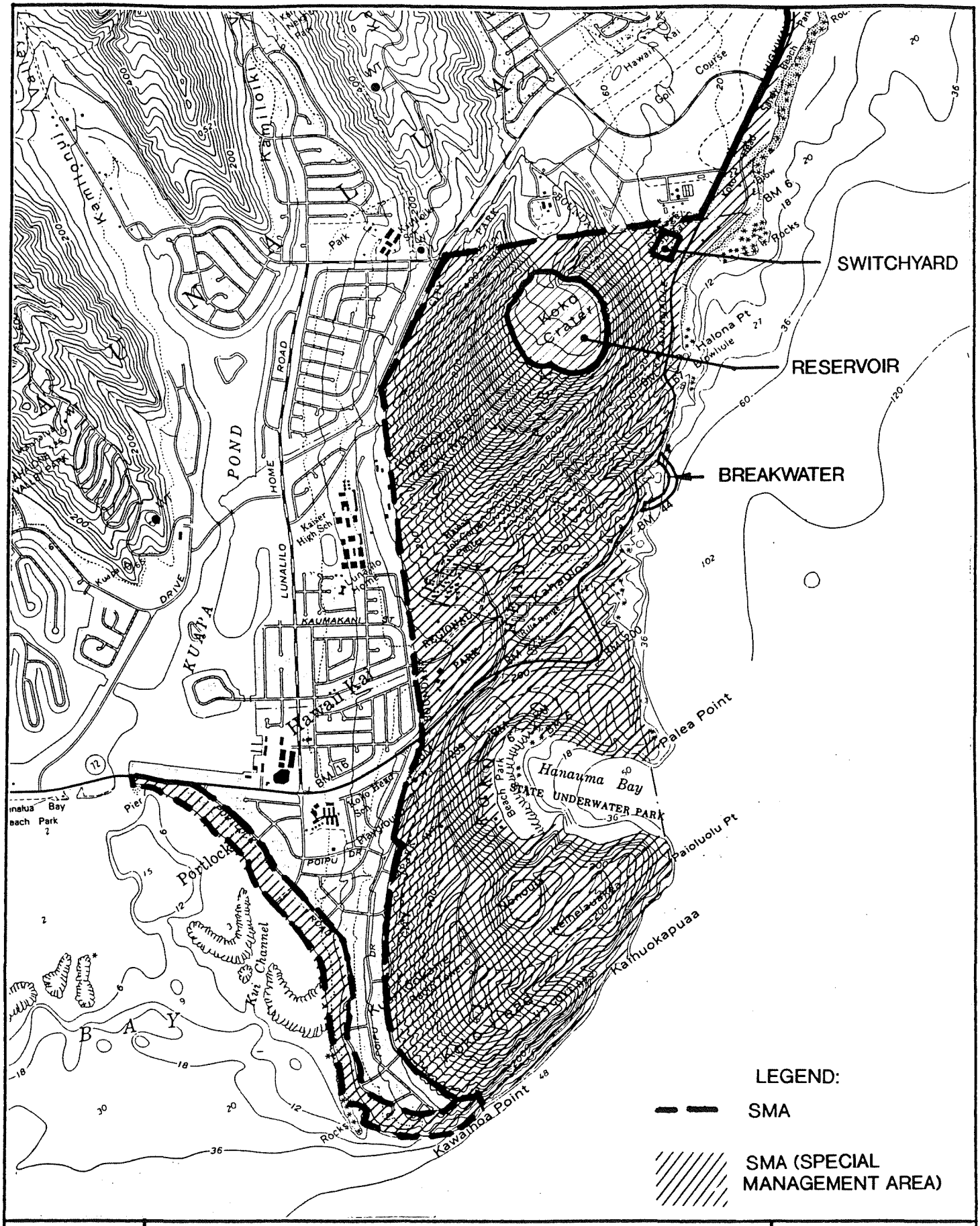
A line 50 feet above sea level from Koko Head to the Blowhole. From the Blowhole a line extending one-half mile inland of Sandy Beach through the FAA Radio Station and the Hawaii Kai Golf Course Clubhouse. From the clubhouse along Kalanianaole Highway to its junction with the Makapuu Lighthouse road. Then around Makapuu Head at the 50-foot elevation above sea level.(4)

The only proposed structures within this area are the tunnel beneath Kalanianaole Highway and the breakwater offshore. Even though situated mauka of the highway, the below-grade elevation of the generating station/pump house would require evacuation in the event of an impending hurricane or tsunami due to the possibility of flooding the break water access tunnel. Depending on the final site, a portion of the switchyard could also lie within the Civil Defense tsunami inundation area.

The City and County of Honolulu, pursuant to Part II of Chapter 205A, Hawaii Revised Statutes, is authorized to regulate development within the Special Management Area (SMA). The SMA boundary in the project area is shown on Figure II-6. Several significant guidelines used to evaluate developments in the SMA are as follows:

Alterations to existing land forms and vegetation, except crops, and construction of structures shall cause minimum adverse effect to water resources and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake. The development will not have any substantial, adverse environmental or ecological effect except as such adverse effect is minimized to the extent practicable and clearly outweighed by public health and safety, or compelling public interest; Minimize any development which would reduce or impose restrictions upon public access to tidal and submerged

lands; Minimize any development which would adversely affect water quality, existing areas of open water free of visible structures, existing and potential fishing grounds...



KOKO CRATER HYDROELECTRIC PROJECT

SPECIAL MANAGEMENT AREA BOUNDARY

FIGURE II-6

The proposed breakwater would seem to conflict with several of these guidelines. It would alter scenic and recreational resources; it would impose restrictions upon public access to tidal and submerged lands; it would add a highly visible structure within a presently open water area; it would adversely impact several types of fishing activities; and it could alter water quality in the immediate vicinity.

b. Significant Environmental Resources

Archaeology.

Koko Crater, known to the Hawaiians as Kohelepelepe, is a traditional cultural historic site. The shape of the crater is the subject of a legend concerning Pele and her sister, Kapo. According to correspondence from the Administrator of the State Historic Preservation Division (SHPD):

> *There are three known archaeological historical sites at Koko Crater, all on the outer slopes. Site 50-80-15-36, is a house site of undetermined age on the low ridge of Koko Crater, Makapu'u side. Site 50-80-15-37, is a series of terraces and a possible house site on the northwest slope of Koko Crater, facing Kamilo Iki Valley. Site 50-80-15-4194, is a human burial of undetermined age on the southeast slope of the crater that was found by hikers and reburied by our staff. We believe that other human burials are likely to be found at Koko Head Crater. The crater has not been inventoried for historic sites, so we do not know whether there are sites present within the crater. The environmental conditions make it an unlikely place for traditional Hawaiian settlement, so we would not expect extensive remains.*(7)

Appendix D contains a review of known archaeological information regarding the project sites. This report was prepared by SHPD staff archaeologist, Ms. Carol Kawachi, who performed a literature review and a limited site survey. With respect to the Koko Crater area, her report summarizes...

Maunalua is a large land area which was extensively developed in the 1960s-1970s into Hawaii Kai, a residential neighborhood. Development has obliterated most of the inland sites but undeveloped coastlines, deep valleys and steep slopes may still yield remnants of past times. Post-Contact land use included sweet potato cultivation and ranching.

Farming in the terraces in the back valleys was probably during the rainy season but the dominant crop appears to have been sweet potatoes planted on the coastal plain and along the slopes. Permanent habitation was probably along the shores of Kuapa Pond and the sea. Fishing and sweet potato cultivation appear to have been the prime activities of the area.

The presence of only three small probable heiau in such a large area and the lack of smaller divisions of lands ('ili), suggest that Maunalua was not a place of high-status residents.

With respect to Koko Crater itself...

Very little has been written about the proposed project area. An archaeological survey is needed within the crater and along the seaward exit to determine whether significant archaeological sites are present. It is not likely that habitation or agricultural sites would be found on the crater floor. It is likely, however, that burials might be found on the interior slopes

and the crater floor. However, the crater is a traditional cultural place associated with Pele accounts.

These conclusions agree with those of the Koko Head Park Master Plan study which summarizes the archaeological significance of the park lands as follows:

In comparison to areas adjacent to the west, north and east, the Koko Head Regional Park project area would appear to have a relative paucity of archaeological sites....Perhaps this paucity of sites reflects the relatively marginal nature of most of the project area, in terms of traditional habitation and exploitation activities, when compared to the areas adjacent to the west, north and east.(4)

Earlier studies reviewed in production of the Park Master Plan suggest the likelihood of habitation sites and possibly dryland agricultural sites in several areas including natural overhang shelter areas along the dissected, seaward-facing lower slopes of Koko Crater, above Kalanianaole Highway, the interior of Koko Crater, especially immediately adjacent to the base of the steep slope, and the two ridge areas, now covered with dense vegetation, that extend to the northeast on both sides of the gap into Koko Crater.(4)

Many of the surface prehistoric and historic sites in the area, particularly along the coastline and in low areas such as Sandy and Queens beaches, were destroyed by the 1946 tsunami.(8)

Current Uses.

Current uses of Koko Head Park are described in the Park Master Plan as follows:

For the most part, Koko Head Regional Park has remained an undeveloped area. However, there are nine separate areas within the park that are subjected to varying levels of recreational and non-recreational use. These include the summit of Koko Head upon which are located a number of radio antennas and microwave relay stations, the Hanauma Bay Nature Park and Underwater Marine Life Conservation Area, Blow Hole and Halona Point, the Koko Head District Park, the Hawaii Job Corps Center, the Koko Head Rifle Range, Koko Crater Botanical Garden, and Koko Crater Stables and Sandy Beach.

Areas of the Park which would be impacted by implementation of the PSH project include the shoreline and nearshore waters, the Botanical Garden and the Stables. The Master Plan summarizes these pertinent resources as follows.

The Koko Head viewshed is well recognized for its unique visual assets. The entire park has both regional and local scenic resources....The scenic drive provides an uninterrupted visual sequence of the park's shoreline and its unique geological features as well as views of Lanai and Molokai. Three lookout points with access off Kalanianaole Highway include: Kuapa Pond Lookout with views overlooking Hawaii Kai and Koko Crater; Lanai Lookout and Halona Point/Blowhole Lookout which have views of Lanai and Molokai and the shoreline to Makapuu.

Aside from beach-related activities such as sunbathing, swimming and surfing, the only other major activity along the park's shoreline is fishing and food gathering.

One of the most popular destinations, if not widely known, is the tramway running up the face of Koko Crater. Although difficult to climb, the reward to be found at the 1,200 foot summit is a variety of spectacular views

ranging from Diamond Head to Makapuu Point. Despite being closed since 1966 the tramway remains remarkably well-preserved and offers the hiker a challenging exercise....(4)

Koko Crater Botanical Garden (including the Dean G. Conklin plumeria grove and the Charles M. Willis cactus garden) is one of four botanical gardens administered by the Department of Parks and Recreation of the City and County of Honolulu. The Koko Crater Botanical Garden is open to the public from 9 a.m. to 4 p.m. daily except Christmas and New Year's. The garden's objective is to conserve and protect the unique and endangered plants found in xeriphytic (desert) environments. The garden was first planted in 1957, and has grown to be an important collection, including over 1,000 species from around the world. According to Mr. Walter Ozawa, Director of the City Department of Parks and Recreation, "The garden contains a unique, 20-year old collection of rare and endangered Madagascan plants. Other notable features of the garden include a stand of native Hawaiian wiliwili trees which are on the City's list of protected exceptional trees, a 30-year old collection of cacti and succulents, and Hawaii's largest collection of hybrid plumeria." In reference to the possible use of Koko Crater for PSH, Mr. Ozawa considers the garden "...too valuable a community resource to be abandoned....", and goes on to say, "We, therefore, will not consider changing the use of Koko Crater."(9)

In 1962, the city's Parks Department issued a ten-year lease to a private contractor for the establishment of a stable and riding facility at the mouth of Koko Crater. The result has been the creation of a 10-acre facility, complete with polo field/arena, practice area, and boarding facilities for up to 60 horses. Originally, the stable was a western riding facility. However, in the early 1970's the facility expanded and became an English-riding facility. Trail rides were once provided around the Koko Crater area but have been discontinued due to the rising costs of liability insurance....the Stables...is recognized as Oahu's only English training facility.(4)

The proposed Pumped Storage facility would displace the botanical garden and probably the stables, although the future of the stables beyond its present owners is somewhat conjectural in any event. Shoreline vistas would be altered by the visual intrusion of the breakwater structure. Views into the crater from mauka hillsides would be altered by the presence of the dam and reservoir.

The Master Plan further expresses concern about potential uses near the park such as in the area envisaged for the switch yard.

> *...existing and proposed land uses around the park may constrain future recreational activities. Of particular concern is the sewage treatment plant (STP) across the highway from Sandy Beach, the proposed light industrial area mauka of the STP, the residentially zoned area adjacent to the entrance to Koko Crater, and development of telecommunications facilities on Koko Head summit.*(4)

> *The East Honolulu Treatment Plant, located east of Koko Head Crater....is a 3.9 million gallon per day (mgd) activated sludge facility....Following secondary treatment, effluent is discharged into coastal waters via a 1400-foot long, 46-foot deep and 36-inch diameter outfall pipe.*(4)

Recommended improvements to park lands and facilities include, among other things, construction of new hiking trails along the crater's slopes, improvement of the tramway trail, and improvements to the botanical garden, itself the subject of a separate Master Plan.

In addition to the City's plans for the park proper, the State Legislature in 1988 adopted two resolutions calling for the creation of a new park area, to be called Ka Iwi Park, extending from Makapuu to Hanauma Bay. To examine the potential of the area for inclusion in the National Parks System, the National Parks Service (NPS) completed

a reconnaissance survey of the area and studied management alternatives.(8) They concluded the area does not meet all criteria for establishment of a National Park. Nevertheless, the state is in the process of preparing its own master plan for the Koko Rift area and is considering a Ka' Iwi State Park that would incorporate Makapuu State Park and some of the intervening private lands in the area, permitting public access to the Makapuu area....The 1992 master plan for the area calls for a redesign of the existing Sandy Beach parking area and an extension of Sandy Beach road to provide greater access to the Ka Iwi shoreline.(8)

Flora.

Introduced plant species dominate the area. Native plant communities are restricted to the harshest locations where their particular characteristics have allowed them so far to out compete alien species. The Hawaii Heritage program database identifies one listed endangered plant species, the 'Awiwi, a native coastal plant. The last sighting of the 'Awiwi is uncertain.(3)

On the Regional Park site, five general vegetation types are recognized. On the rocky coastal cliff areas and windward facing slopes of Koko Head, the vegetation is of low stature due to exposure to the prevailing winds and, during periods of storms and high surf, to salt spray. This **coastal scrub** is composed primarily of native species which occur as scattered pockets between the cliffs and Kalanianaole Highway. The **strand vegetation**, characterized by beach naupaka shrubs, occurs on sandy areas between Sandy Beach and Queen's Beach. Inland of the highway, on the windward facing slopes of Koko Crater and on a large portion of Koko Head, **kiawe scrub** with open, grassy patches is the dominant vegetation type. In more sheltered areas, the kiawe forms a forest, 12 to 25 feet tall, with a subcanopy layer of koa-haole (**kiawe/koa-haole forest**). On the leeward facing slopes of Koko Crater, a **koa-haole scrub** with a few scattered kiawe trees can be found.

Although no endangered species of flora or fauna have been identified within the park, a native water fern (*Marsilea villosa*) listed as a Category 1 (likely to be listed) proposed endangered species by the U.S. Fish and Wildlife Service (1985), has been found at 'Ihi'ihilauakea Crater. The Nature Conservancy of Hawaii, together with the City and County of Honolulu, have prepared a management plan for the area. Although not widely publicized, since 1987 'Ihi'ihilauakea Crater has been under the management of the Nature Conservancy in an effort to protect the native vegetation. The primary focus of the Conservancy's management plan has been to restrict vehicular access to the crater.(4) 'Ihi'ihilauakea Crater is southeast of Hanauma Bay, and nearly a mile and a half away from any disturbance which would be associated with the PSH project.

Schiedea globosa and *Lipochaeta lobata* are considered rare. They are found in the coastal scrub and kiawe scrub, near the rim of Koko Crater. The native caper or pua-pilo (*Capparia sandwichiana*), another rare species, was reported from the general Koko Head area and from Halona Point.

Fauna.

A field survey of the Koko Crater site was conducted by Dr. Leonard Freed on October 17, 1993. His report, summarizing the results of the field survey and literature reviews, as well as consultations with biologists at the Bishop Museum, U.S. Fish and Wildlife Service, Hawaii State Division of Forestry and Wildlife, and the University of Hawaii, comprises Appendix A to this report. No endangered, threatened, or declining species were seen or heard. Animal taxa in the area are typical of dry coastal and lowland settings on Oahu.

The threatened White Tern (*Gygis alba rothschildi*) on Oahu is known from a nesting attempt at Koko Head during 1961. It may therefore occur at Koko Crater, although the population now on Oahu is concentrated in Kapiolani Park and portions of urban Honolulu.

The Hawaii Heritage program database identifies one federally-listed endangered animal species, the Hawaiian Hoary Bat (*Lasiurus cinerus semotus*). The bat was last observed in 1963. The Short-eared Owl or Pueo (*Asio flammeus sandwichensis*), an endemic land bird, has been observed on Koko Crater near Halona Point. The subspecies is listed as endangered on Oahu by the State of Hawaii Department of Land and Natural Resources Division of Forestry and Wildlife.(3) The Pueo inhabits dry forests and rain forests, but is most often seen hunting in grasslands. It may occasionally forage through the Koko Crater site.

Two migratory indigenous (native) birds, the Pacific Golden Plover (*Pluvialis dominica fulva*) and the Wandering Tattler (*Hereroscelus incanus*) utilize the study area. The Plover is highly site-faithful year to year.(3) Two migratory indigenous (native) shorebirds, the Ruddy Turnstone (*Arenaria interpres*) and Sanderling (*Calidris alba*) are common along the shoreline.(3) Numerous species of resident indigenous (native) seabirds overfly and some nest on the inaccessible seaward facing cliffs at Koko Head.

2. OCEAN BREAKWATER/INTAKE

a. General Site Characteristics

The marine areas potentially affected by implementation of the Pumped Storage Project include those areas from the "Lanai Lookout" to Sandy Beach. This segment of coastline also includes the Halona Blowhole, a popular tourist attraction. Waters offshore of this coastal area are heavily used by sport divers and fishermen. Sandy Beach is a public beach that is particularly popular with bodyboarders, bodysurfers, and surfers.(3)

The unique and spectacular appearance of the coast between Hanauma Bay and Sandy Beach is due to the type of volcanic material - tuff (hardened ash) - of which it is composed. Tuff is relatively easily eroded and sculptured by wind, waves, and wave spray. The stretch from Palea Point to Sandy Beach has the most conspicuous and most

complete assemblage of water-leveled landforms on Oahu. Typically there is a distinct bench or low terrace cut in the tuff a few feet above sea level. Bench elevations are higher at points and lower in more protected settings. Tidepools are present in the bench at the base of Halona Point.(2)

The entire coast from Koko Head to Makapu'u Head is geologically youthful. Coral growth occurs as scattered heads rather than as true reef formations. Deep waters occur very close to shore. The sea cliff along the ridge between Lanai Lookout and the Halona Blowhole extends underwater as a plummeting face, in some places with a vertical drop of 40 feet. Southwest of Halona Cove, depths of 50 feet or more occur directly off the shore. The bottom is predominantly sand, with scattered rocks, including some massive tuff breccia. Sand bottom areas increase with depth.(2)

b. Significant Environmental Resources

Archaeology.

To the southwest of the proposed breakwater site are the Koko Head Petroglyphs which, although extensively altered over the years by wave erosion and collectors, are recognized by DLNR as being significant examples of petroglyph art, rare on Oahu.

Current Uses.

Uses of the coastal area are summarized in the *Oahu Coral Reef Inventory*(2), from which most of the below information is taken. At Lanai Lookout, a parking area off Kalanianaole Highway provides access to a scenic viewpoint. The lookout northeast of Halona Cove is visited by large numbers of people daily who view the Blowhole activity and the rugged coastline. This coast is one of the better places on Oahu to observe humpback (*Megaptera novaeangliae*) and sperm whales which winter annually in offshore waters.

The more or less continuous bench along the coast between Halona Point and Palea Point is a popular hiking and nature-walk area. During calm seas the tidepools at the base of Halona Point offer outstanding nature study opportunities.

The waters off Lanai Lookout are popular for SCUBA diving when seas are calm. Underwater visibility is exceptional, at times reaching 150 feet or more, providing good opportunities for underwater photography. Large fish populations and submarine erosional features on a submerged shelf of tuff are major attractions. Commercial dive shops take advanced SCUBA classes and dive charters into the waters off Sandy Beach. The relatively easy access to deep waters outside Halona Cove make this a popular SCUBA diving area. Commercial dive shops run advanced SCUBA classes and dive charters there. Entries and exits are made from a sandy beach at the head of the cove which is accessible by a trail from the blowhole parking lot. The bottom drops off much faster south of Halona Cove than directly seaward or north toward Sandy Beach. The most interesting diving is found south in the direction of Hanauma Bay, where the bottom plummets to depths over 50 feet immediately offshore. Shell collectors also frequent these waters.(2)

Fishing activity along the coast northeast of Hanauma Bay to Sandy Beach is generally heavy. Pole fishing is the most common method, with Halona Point as the focus of some of the heaviest shore fishing effort on Oahu. Because of its popularity to bamboo pole fishermen, Halona Point is also known as "Bamboo Ridge". Fishes sought here are ulua, papio, surgeonfish, wrasses, and snappers. Other rocky points along this section are also heavily used by pole fishermen. Opihi collectors, as well as shore fishermen, risk their lives when surf is high. Some shorecasting occurs along the beaches at Sandy Beach Park and some throw-netting occurs from the rocky shore northeast of Sandy Beach. Net fishing occurs only rarely. Hand-netting of ornamental fishes is common. Lobster is taken off the rocky point southwest of Sandy Beach. Trapping of reef fishes and crustaceans in the deep waters found close to shore is an important activity along this entire coast.

Sandy Beach is one of the most popular beaches with Oahu's youthful sunbathers, and the body-surfing waves are as popular as those at Makapu'u Beach.

Flora.

The composition of the coastal strand vegetation is described in the terrestrial section above. According to the *Oahu Coral Reef Inventory*(2), the deep water west of Halona Cove harbors dense patches of the seaweed, *Dictyopteris plagiogramma*.

Fauna.

As evidenced by the density of fishermen, sport divers, shell and shellfish collectors, the waters offshore of this reach of coast harbor a diverse and abundant marine fauna typical of rocky surge coastlines in Hawaii. The tidepools along the wave-cut bench are also rich in marine life. The submarine cliff off the coast between Lanai Lookout and Halona Cove drops to a sand bottom with no corals or fishes evident. Heads of the coral *Pocillopora meandrina* occur close to Lanai Lookout, but cover does not exceed 10% and other coral species are not evident. The sea urchin, *Tripneustes gratilla*, is seen occasionally.(2)

3. KOKO CRATER PROJECT POTENTIAL IMPACTS AND MITIGATION MEASURES

a. Construction Phase

Site Work.

Site work would take place in the crater, outside the mouth of the crater, outside the crater mauka of the highway, near the Sewage Treatment Plant, in a 138 KV transmission line right-of-way, and immediately offshore. Underground tunnels, and a

power house would also be excavated through the crater. The site work will directly alter landforms and indirectly, it would be responsible for all of the other construction phase impacts identified below.

The major landform alteration would result from construction of the reservoir and the dam across the crater mouth. The crater floor and inside perimeter would be graded and compacted prior to installation of an impermeable liner. The plans call for a balance between cut and fill so that no significant import or export of soil would be required. The crater's interior topography would be altered to provide uniform sloped surfaces. The mouth of the crater would be dammed, altering the natural form of the crater when viewed from the northeast. Grading would also be required along the access road and at the site of the switchyard. The route of the transmission line is presently defined only schematically, however, it is expected to involve both above ground and under ground site work.

The generally flat, arid and porous crater floor and surrounding lands would tend to mitigate against erosion and runoff problems during construction, but dust generation could be significant. Adherence to the City's Grading Ordinance, frequent watering, and prompt paving of the access road, would reduce dust generation and potential erosion. Adherence to the Clean Water Act would require temporary ponding and other control measures to eliminate siltation into drainage channels during rainfall. Because the project would involve disturbance of more than 5 acres of total land area, an NPDES General Permit under DOH Chapter 55 would be required.

Construction of the outlet structure and breakwater would require installation of temporary sheet pilings, excavation and dewatering at the shoreline and in the nearshore environment. The breakwater would extend from 40 feet below mean sea level to 15 feet above sea level and cover a portion of the ocean bottom. Its 40-foot wide crest would extend offshore about 250 feet in an arc more than 500 feet along the shore line.

Water Quality.

It is not expected that the landside portion of the site work would have significant effects on water quality if appropriate siltation control measures are taken. There are neither surface water sources nor drinking water resources in the area, and erosion can be effectively controlled. The major concern with respect to water quality is generation of suspended solids and turbidity by the shoreline and offshore work. Initial placement of the pilings and rubblemound would cause some turbidity nearby. Subsequently the enclosed area would be dewatered and excavated. A pulse of sediments could be expected when the outlet structure is initially flooded.

The State's general policy against water quality degradation reads as follows (§11-54-01.1, HAR):

> *Waters whose quality are higher than established water quality standards shall not be lowered in quality unless it has been affirmatively demonstrated to the director that the change is justifiable as a result of important economic or social development* ***and*** *will not interfere with or become injurious to any assigned uses made of, or presently in, those waters.* (emphasis added)

As indicated above, construction work will affect the water quality at the site. While this may be a temporary negative impact, the completed structure will permanently interfere with the present uses.

The area in question would be classified as Class A "open coastal marine water" with a Class II "lava rock shoreline" bottom subtype. From Chapter 54, HAR, "Water Quality Standards,":

It is the objective of Class A waters that their use for recreational purposes and aesthetic enjoyment be protected. Any other use shall be permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. These waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control compatible with the criteria established for this class.

It is the objective of Class II marine bottom ecosystems that their use for protection including propagation of fish, shellfish, and wildlife, and for recreational purposes not be limited in any way. The uses to be protected in this class of marine bottom ecosystems are all uses compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation. Any action which may permanently or completely modify, alter, consume, or degrade marine bottoms, such as...wastewater effluent outfall structures may be allowed upon securing approval in writing from the director, considering the environmental impact and the public interest....

In terms of the basic water quality criteria applicable to all waters:

All waters shall be free of substances attributable to domestic, industrial, or other controllable sources of pollutants, including:

> *(1) Materials that will settle to form objectionable sludge or bottom deposits;...*
>
> *(3) Substances in amounts sufficient to produce... objectionable...turbidity...in the receiving waters;*
>
> *(4) High or low temperatures; biocides;...at levels or in combinations sufficient to be toxic or harmful to human, animal plant or aquatic life, or in amounts sufficient to interfere with any beneficial uses of the water;...*

(6) Soil particles resulting from erosion on land involved in earthwork....

Appropriate pollution control technologies and the contents of any required monitoring program would be defined and established in the permitting process with the state and Army Corps of Engineers.

Land Tenure.

Most of the Koko Crater project would occupy lands now owned by the City and County of Honolulu. As noted, there is a restriction on the deed from Bishop Estate to the City requiring approval of the trustees of the estate for any land use other than recreational. Such approvals have been given in the past, such as for the Hawaii Job Corps Center. For a commercial use, however, the estate might seek monetary compensation in exchange for the waiver of the deed provision.(10)

Current plans are to locate the switchyard on city park lands. An alternative location would be on the parcel mauka of the STP owned by Bishop Estate and leased to Hawaii Kai Development Company. These leased lands are designated for limited industrial use on the City's Development Plan Map. Several community groups and City Councilman John Felix would like the parcel down-designated to preservation status (11), and Councilman Felix has initiated a Development Plan amendment.(10) The Department of General Planning is currently reviewing proposed DP amendments, and the administration's position will be published in July. According to Mr. Paul Cathcart of Bishop Estate, the Estate's intentions for the area include development, perhaps into a business park or similar use. A switchyard would not be incompatible with the intended use, and while an adequate area could be made available, the estate would prefer the switchyard be located on City land.

A right-of-way for the 138 KV transmission line would also be required, and would likely pass over private lands (the route this line might take is presently unspecified) and offshore lands are state-owned. All of these areas would have to be acquired or a means for their legal control established, thus eliminating their potential for other uses. Interestingly, the State Agriculture Plan considers the lands in Koko Crater "prime agricultural land, if irrigated."(12)

Recreational and Aesthetic Uses.

Construction of the reservoir and access road would effectively curtail use of a large portion of Koko Head Park. Obviously the Botanical Garden would be displaced, as most likely would the stables. The planned expansion of hiking trails around the crater ridge would not necessarily be inhibited because the reservoir would in any event have to be fenced for safety and security and therefore permit access to the upper reaches of the crater's interior.

Both the Botanical Garden and the stables could be relocated to other suitable areas. The arid environment desired for cultivation of the xeriphytic species may be found in other parts of the island; perhaps a portion of the Barbers Point Naval Air Station could be secured once the base is decommissioned or it could be integrated with the Board of Water Supply's xeriphytic demonstration garden in Halawa Valley. The Diamond Head crater interior and the smaller craters surrounding Hanauma Bay are other sites with environments similar to Koko Crater.

Construction of the breakwater/outlet structure would effectively curtail recreational use of the enclosed area for safety consideration. Partial mitigation might be possible by allowing access to the breakwater crest for fishing the waters on the sea side of the breakwater.

Aesthetically, the project would degrade views into the crater itself, views from the coastal highway and scenic lookouts, and perhaps underwater visibility as well.

Biota.

Lining of the crater floor and internal perimeter would remove vegetation and habitat including rare (though no native) plants within the Botanical Garden and "exceptional trees" listed by City ordinance. Mitigation could include transplantation, propagation or additional importation for cultivation at an alternative site. Some amount of forage area for endangered owls and bats would be lost, but no protected fauna would be directly impacted.

Biota resident in the area to be covered and enclosed by the breakwater would be lost. The breakwater structure itself might provide some complex habitat for encrusting and other species. The velocity of the currents passing through the structure when the facility is operational could inhibit colonization and growth; these velocities are expected to be lower than existing tidal currents. It might be possible to compensate for the lost habitat by creating artificial reefs offshore and adjacent to the breakwater.

Noise.

Development of the project site would involve grubbing, grading, tunnel drilling, road paving, and the construction of the powerhouse and the switchyard. Construction operations can generate significant amounts of noise, although actual noise levels would depend on the methods of construction employed during each stage of the process. Earthmoving equipment such as bulldozers and diesel powered trucks would probably be the loudest equipment used during the construction. Back-up alarms, in particular, have proven especially disturbing to residents near construction sites. Because of the distance between the proposed project location and nearby residence, the noise from construction

operations would not cause "unreasonable" or "excessive" noise as defined by "Chapter 43 - Community Noise Control for Oahu".(13)

All construction equipment and on-site vehicles or devices requiring an exhaust of gas or air must be equipped with mufflers. Also, construction vehicles using trafficways will satisfy the noise level requirements adopted for Oahu for similar noise generation ("Chapter 42 - Vehicular Noise Control for Oahu").(14)

It is likely that blasting would be employed in excavating the tunnels and below-grade generating station. Prior to blasting, potentially affected neighbors should be notified. If blasting within the marine environment is necessary, consultation with the National Marine Fisheries Service will be required to establish measures to mitigate potential impacts on endangered humpback whales and threatened green sea turtles.

Traffic and Air Quality.

Traffic in the project area would increase during construction due to delivery of equipment and materials and particularly worker vehicles. Even if there are no direct lane closures required by the project, work visible from Kalanianaole Highway has the potential to impede traffic flow due to "rubberneckers."

Short-term direct and indirect impacts to air quality could potentially occur due to project construction. There are two types of air pollutant emissions which could directly result in short-term air quality impacts during the construction phase: (1) fugitive dust (particulate matter) from vehicle movement and site excavation; and (2) exhaust emissions (primarily nitrogen oxides, but also carbon monoxide, sulfur oxides and hydrocarbons) from on-site construction equipment. Indirectly, there could also be short-term impacts from slow-moving construction equipment traveling to and from the project site and from a temporary increase in local automotive traffic caused by commuting

construction workers. Carbon monoxide comprises the largest fraction of emissions from gasoline-powered vehicles.

Strict compliance with State of Hawaii Air Pollution Control Regulations (Section 11-60-5, HAR) regarding establishment of a regular dust-watering program and covering of dirt-hauling trucks would be required to effectively mitigate fugitive dust emissions from construction activities. Twice-daily watering is estimated to reduce dust emissions by up to 50 percent. Soil transported onto paved roads by construction vehicles and activities should be promptly removed. Use of wind screens and/or limiting the area that is disturbed at any given time may be required in such a dust-prone area. Paving of designated areas, landscaping as early as possible in the construction sequencing, and timely installation of the reservoir liner would reduce total fugitive dust emissions. Construction equipment should be properly maintained and tuned to minimize exhaust emissions (Section 11-60-4, HAR) and equipment should be shut down rather than left idling when not in use.(15)

Archaeological Resources.

The portions of Koko Crater with traditional significance in Hawaiian legends (the summit) would not be modified in any way, although the appearance of the crater from above would change with the addition of the dam and reservoir. Potential archaeological resources at the crater mouth, along the inside of the crater walls and along the outside of the walls could be impacted by construction. Additional archaeological surveying and possibly mitigation work would be required before proceeding with the proposed project.

b. Operational Phase

Water Quality.

The PSH facility would cycle about 1 billion gallons of seawater each day. Marine water quality impacts could result from both the uptake and discharge cycles of the process. During uptake and discharge scouring of the ocean bottom may result in increased turbidity due to the suspension of bottom materials. This impact could potentially be mitigated by locating the outfall/intake at great depth and the installing of diffusers. The water discharged could differ from that taken up in temperature, oxygen content, and chemical composition. The latter could be affected by the introduction of cleaning agents to the system. Mitigation could involve selection of low toxicity agents and restricted concentrations, or use of mechanical cleaning methods. Destruction of organisms and lysing of cells could increase the concentration of organics in the discharge.

Oxygen depletion and thermal changes are always of concern when they occur in marine waters. These effects could result from the stored water warming and from oxygen depletion at depth in the large reservoir. These impacts, however, are anticipated to be essentially non-existent due to the short residence time of the water in the reservoir. Approximately 85% of the water in the reservoir would be exchanged each day, and the filling and draining of the reservoir would result in significant mixing of the residual water, thereby minimizing oxygen depletion effects and thermal changes.

Land Use.

Although the visible shoreside facilities would not, with the exception of the electrical switchyard, appear industrial in character, the proposed project would constitute an expansion of industrial uses and facilities adjacent to lands designated preservation, and extensively used for recreational purposes.

Although mitigation measures could significantly reduce some of the consequences of the proposed action, the breakwater would seem to conflict with several of the SMA guidelines. It would alter scenic and recreational resources; it would impose restrictions

upon public access to tidal and submerged lands; it would add a visible structure within a presently open water area; it would impact several types of fishing activities; and it could alter water quality in the immediate vicinity.

Industrialization of the area might affect residential property values as could a perceived potential for seawater overflows as a consequence of operational problems or leakage from the reservoir resulting from natural disasters. An effective public information program might allay such fears.

Recreational and Aesthetic Uses.

The proposed PSH facility would have recreational, aesthetic and cultural impacts. The primary impacts to recreational use would result from displacement of the botanical garden and probably the stables, although the future of the stables beyond its present owners is somewhat conjectural in any event. Hiking opportunities both in and on the crater and along the coastline would be reduced. In the area of the outfall structure and breakwater, access for fishing and diving would be lost, although the breakwater represents a small portion of the coastline. The currents outside the breakwater resulting from intake and discharge of water through the PSH facility would not be of a magnitude to endanger nearby divers.

Aesthetic impacts would be significant. Shoreline vistas would be altered by the visual intrusion of the breakwater structure. Views into the crater from mauka hillsides would be altered by the presence of the dam and reservoir. Although the powerhouse would be below grade, the other appurtenances including the switchyard and any overhead transmission lines would have negative aesthetic effects.

Because the crater's shape is an integral part of the Pele Legend, altering the crater shape by the addition of a dam could have significant cultural effects. The relevant

portion of the crater, however, is the crest area to the southwest, opposite the mouth where the dam would be built.

Biota.

Impacts to biota from operations of the PSH facility would affect both terrestrial and marine ecosystems. The main impacts to terrestrial habitats would take place during construction and start-up, but operations and maintenance would continue to affect terrestrial biota through vegetation removal along rights-of-way and at the switchyard. There will perhaps be a microclimate modification in the crater due to the presence of a large body of salt water in the reservoir.

Marine biota could be affected in a number of ways. Direct effects could include impingement and entrainment of plankton and nekton due to the velocities in the waterways. The breakwater would help to filter the intake and diffuse the discharge, but undoubtedly some organisms would be carried into the flow stream. Organisms too large to pass through the voids in the breakwater could still be damaged by impingement on the rocks. Smaller organisms which pass through the breakwater would undergo mechanical stresses associated with passage through the system into the reservoir and a high percentage of entrained organisms would likely be destroyed. The discharge plume at the breakwater is expected to have a velocity of about 0.4 fps (1/4 knot). This velocity is typical for natural currents in the area.

Noise.

Noise from the PSH facility would result from operation of the pumps and generator, and to some extent from the moving water itself. The combined pump house/generating station would be below grade, thereby greatly reducing ambient noise impacts, especially at higher frequencies. There may also be some noise associated with

operations of the switchyard, but this would be localized. The mechanical noise propagated through the water may have an impact on whales which traverse the area.

Air Quality and Climate.

Air quality effects at the site would be minimal and would primarily be associated with the incremental increase in emissions at established power plant sites which provide electricity to the PSH facility during pumping operations. The project itself would have no emissions of air pollutants; it would actually result in lower island wide emissions because of its displacement of fossil-fuel generators during peak power production.

The presence of a large water body in the crater could alter the microclimate to which flora on the upper slopes of the crater interior is exposed by increasing local humidity and lowering temperature through evaporative processes. Mitigation of this potential impact would involve covering the reservoir. This measure is an unnecessarily complex and expensive remedy, considering the quality of the resident flora.

EMF and RI.

Electrical switching gear and transmission lines generate ambient electro-magnetic fields (EMF). There appears to be no definitive linkage of EMF and human health or ecological risks at this time. Some localized radio interference (RI) could occur around the high voltage facilities.

4. SOCIOLOGICAL/POLITICAL CONSIDERATIONS

a. Housing/Infrastructure

With the exception of the necessity for a right-of-way for a 138 KV electrical transmission line from the switchyard to the Pukele substation in Palolo Valley, direct

impacts to housing would be minimal. Depending on the route selected, property acquisitions both public and private might be necessary. Effects on infrastructure in Hawaii Kai would be minimal.

b. Neighborhood Board Concerns

On August 10, 1993, Fred Kobashikawa (HECO) briefed the Planning and Zoning Committee of the Hawaii Kai Neighborhood Board on the pumped storage hydro concept for Koko Crater. Summarizing the contents of the report "Integrated Resource Planning, 1994-2013," Mr. Kobashikawa cited potential visual and environmental impacts. Identified potential impacts include loss of marine benthic communities, impingement and entrainment of marine organisms, elevated discharge water temperature, as well as the visual intrusiveness of the dam, powerhouse and transmission lines. Seismic instability of the area and the potential for a natural disaster was a concern of some board members. Further presentation of the findings of this report will need to be undertaken to identify the mitigations that are available to meet the neighborhood board concerns.

c. Residential Concerns

At the Hawaii Kai Neighborhood Board meeting (reported in the *Hawaii Kai Sun Press*), residents of the area were invited to submit comments on the proposal to the Public Utilities Commission. Only one letter has been submitted to the PUC and it was negative toward the project.

5. REGULATORY REQUIREMENTS

The project would need permits and approvals at federal, state, county and private levels to proceed (Table 1). The coordinating agency at the federal level would be the Army Corps of Engineers. Construction of a breakwater in the navigable waters of the United States would require a Corps permit under Section 10 of the Rivers and Harbors

Act of 1899 (33 U.S.C. 403). The need for a federal permit would trigger additional requirements. The magnitude of potential impacts would likely trigger a federal environmental impact statement (EIS) under the National Environmental Policy Act (NEPA). Hydroelectric projects normally require licensing by the U.S. Federal Energy Regulatory Commission (FERC), however, it is not clear that the State of Hawaii is subject to FERC regulation.

Section 7 of the Endangered Species Act (ESA), 16 U.S.C. 1536, requires that each federal agency insure that any activity authorized, funded or carried out by it is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any critical habitat for such species. Construction and operation of the Pump Storage facility would involve modification of the physical environment as well as potential impacts on living organisms. Accordingly, review of the project for endangered species impacts will form a part of the process of granting any federal permit or authorization for the project.

The Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661-666c, requires that federal permitting agencies give full consideration to conservation of wildlife resource values in the permitting process. This is accomplished through consultations between the permitting agency and the affected state wildlife agency, the U.S. Fish and Wildlife Service Regional Director and the National Marine Fisheries Service Regional Director, as appropriate. The purpose of these consultations is, to the maximum practical extent, to avoid project-caused losses of wildlife resources, to compensate for unavoidable wildlife resource losses, and to enhance wildlife resource values.(16)

If the proposed Humpback Whale National Marine Sanctuary is established, and if the sanctuary is defined to include all Hawaii waters shallower than 600 feet, as one alternative now reads, then a National Marine Sanctuaries Review under the Marine Protection, Research and Sanctuaries Act (16 U.S.C 1431-1434) would be required.

Because Hawaii has an approved Coastal Zone Management Program, a Coastal Zone Management Consistency Certification (Section 307(c) of the Coastal Zone Management Act of 1972 (16 U.S.C. 1456 (c)) would be required. An applicant for any federal license or permit must certify that the proposed activity is consistent with the state plan.

A state Water Quality Certification from DOH pursuant to Section 401 of the Clean Water Act is required by any applicant for a federal license or permit to conduct an activity in state waters that would include the construction and operation of facilities that may result in any discharge.

Emplacement of the breakwater would also have to meet U.S. Coast Guard Navigation Safety Requirements.

Much of the proposed infrastructure for the project would be situated on lands classified Conservation by the state. Accordingly, a Conservation District Use Permit (CDUP) would be required from the Board of Land and Natural Resources. Use of Conservation District Lands would also trigger a state EIS under Chapter 343, HRS. Historic Site Review (Chapter 6A) would be undertaken as part of the EIS process. The requirement for a permit for work in ocean waters of the state, is consolidated into the CDUP process when a CDUP is required. A revocable permit for use of state lands would also be required from the Division of Land Management.

Construction of the dam and reservoir would require a permit from the BLNR. If the dam is judged to be of high hazard, an emergency preparedness plan would be required.

The ocean discharge would require an individual National Pollutant Discharge Elimination System (NPDES) permit which would typically set limits to pollutant concentrations and establish monitoring requirements. Because the project would involve

disturbance of more than five acres of total land area, an NPDES General Permit under DOH Chapter 55 (Hawaii Administrative Rules) for "Discharges of Storm Water Associated with Construction Activity" would be required. A second NPDES General Permit will be required for "Discharges Associated with Construction Activity Dewatering" Similarly, an NPDES General Permit will be required for "Discharges of Hydrotesting Waters."

If it is determined that the discharge water from the facility would violate state Water Quality Standards, a zone of mixing or a treatment system would have to be approved by the Department of Health.

It is anticipated that Kalanianaole Highway would not be directly affected by the construction; nevertheless, a permit to perform work upon a state highway may still be required, as the right-of-way extends below grade where the underground tunnels will be located. A permit may also be required to install utilities within the state highway right-of-way.

At the City and County level both discretionary and ministerial permits would be required. The Development Plan would require amendment, which may in turn trigger an EIS requirement. Most of the project area is within the Special Management Area (SMA), and an SMA Use Permit would be required. A single EIS can be written to fulfill the requirements at federal, state and county levels. Construction within the Shoreline Setback would require a variance. This is usually combined with the SMA permit process.(17) A Zoning Waiver for Public Utilities may be granted by the Director of Land Utilization, and may be appropriate for the proposed project.

Ministerial permits would include a Building Permit, Certificate of Occupancy, and a Grubbing, Grading and Stockpiling Permit. The contractor will be required to prepare an erosion control plan prior to receiving a grading permit.

Another approval would have to come from the Trustees of the Bishop Estate pursuant to a deed restriction on the property specifying it be used for recreational purposes only.

The permits and approvals necessary to develop the Koko Crater site are listed in Table II-1.

TABLE II-1

KOKO CRATER PERMITS AND APPROVALS

PERMIT OR APPROVAL	AGENCY OR ENTITY
Section 10 Permit (Rivers and Harbors Act)	U.S. Army Corps of Engineers (COE)
Section 7 (ESA) Consultation and Fish and Wildlife Coordination	COE with National Marine Fisheries Service (NMFS), Fish and Wildlife Service (FWS) and Hawaii Department of Land and Natural Resources (DLNR)
Environmental Impact Statement (NEPA)	COE, Office of Environmental Policy
Navigational Safety Certification	U.S. Coast Guard
Coastal Zone Management Program Consistency Certification	Hawaii Office of State Planning
Water Quality Certification	Hawaii Department of Health (DOH)
Conservation District Use Permit	Hawaii Board of Land and Natural Resources (BLNR)
EIS (Chapter 343, HRS)	Governor (through the Hawaii Office of Environmental Quality Control)
Historic Site Review (Chapter 6A, HRS)	DLNR, Division of Historic Preservation
Revocable Permit for Use of State Lands	DLNR, Division of Land Management
Dam Safety Approval	BLNR

NPDES Permits	DOH
Permit to Perform Work on State Highway	Hawaii Department of Transportation (DOT)
Permit to Install Utilities Within State Highway Right-of-Way	DOT
Use of City Land	Honolulu City Council
Development Plan Amendment	Honolulu Department of General Planning (DGP) and Planning Commission
Special Management Area (SMA) Use Permit	Honolulu Department of Land Utilization (DLU) and City Council
EIS (Chapter 25, ROH)	DLU and DGP
Shoreline Setback Variance	DLU
Zoning Waiver for Public Utilities	DLU
Building Permit	Honolulu Building Department (BD)
Certificate of Occupancy	BD
Grubbing, Grading and Stockpiling Permit	Honolulu Department of Public Works (DPW)
Deed Waiver for Non-recreational Use	The Bishop Estate

C. KAAU CRATER PROJECT

1. KAAU CRATER

a. General Site Characteristics

Kaau Crater is within Oahu Tax Map Key 3-4-22:06. This parcel, owned by the City and County of Honolulu, is shown on Figure 7. The Kaau Crater site is located high on the Honolulu side of the Koolau range, deep in Palolo Valley. The crater and the surrounding lands are located in the Honolulu Watershed Forest Preserve which is surrounded by State lands of the Pukele and Waiomao Forest Reserves. The state land use designation is Conservation, and the County zoning is Preservation P-1. The geological characteristics are discussed in section III.

b. Significant Environmental Resources

Archaeology.

According to Don Hibbard, Historic Preservation Division Administrator:

Kaau Crater is State site 50-80-14-57. The crater, itself, is significant in traditional Hawaiian culture as the grave site of the demi-god Maui's fishhook, Manaiakalani. The crater has not been inventoried for archaeological remains or historic sites and none are known to be present. Given the crater's location and its swampy interior it is unlikely that habitation or agricultural remains will be found there. Sediments within the crater will undoubtedly contain a good record of vegetation changes through prehistory, and so would be considered significant for the information on Hawaiian history and prehistory that they contain.(7)

MANOA VALLEY

SECTION 9

ZONE 2

TRUE NORTH
1" = 400'

Manoa & Palolo Boundary Line

WAILUPE

PUKELE

(C.S.F. 5653)

State of Hawaii
601.00 Ac.

KEHJO

FOREST RESERVE

MT. OLYMPUS

KONAU RANGE

PLAT 20

PLAT 27

PLAT 21

PLAT 18

GRANT 5188

GRANT 6141

LAND COURT APPLICATION 1069

3-4-94
6
CITY & COUNTY OF HONOLULU
(BD OF WATER SUPPLY)

UPPER RESERVOIR

KAAU CRATER
22

KAAU CRATER HYDROELECTRIC PROJECT
LAND OWNERSHIP

FIGURE 11-7

Pukele Stream

HSAEA

L. C. Aw. 5931:4

L. C. Aw.

WAIOMAO

Waiomao Stream

Mahe Range

Waialae Nui & Waiomao Boundary Line

SECTION 5

Dropped Parcels: 2343

3-4-94
STATE OF HAWAII

ZONE 3

Ms. Carol Kawachi, staff archaeologist with the State Historic Preservation Division summarized the existing information regarding the crater. Her report comprises Appendix D to this report. With respect to the area around Kaau Crater...

The valley floors of both Palolo and Manoa Valleys were once extensively cultivated in taro pondfields. The streams from both valleys met and watered the large pondfield system and fishponds between Mo'ili'ili and Waikiki. From Wai'alae to Kuli'ou'ou, there were only intermittent streams. The agricultural pattern was mainly dryland agricultural on the coastal plains with taro pondfields along the flowing streams. Each 'ili had a fishpond. Some had terraces but what specific crop was being cultivated is unknown. Dryland taro was cultivated where there was sufficient rainfall. Sweet potatoes and other crops were also cultivated on the broad coastal plain. Palolo and Manoa 'ili held large populations, with many on the shore and others scattered inland. The numbers of awards and early census data indicate the larger populations of these 'ili. The small valleys to the east seem to have had much smaller populations based on Mahele data with most living on the shore.

With respect to Kaau Crater...

There is no archaeological information on the crater so an archaeological inventory survey would be needed for planning. It is not likely that habitation or agricultural remains would be found on the floor of Kaau Crater, which is presently a marsh.

Oral accounts clearly show that the crater and its spring are traditional cultural places. Both would be significant for their traditional cultural significance. This fact might be a constraint for the project.

Current Uses.

The crater is a destination for recreational hikers and the Hawaiian Trail and Mountain Club organizes group excursions to the crater.(18) The area is also frequented by pig hunters.

Flora.

According to a preliminary environmental assessment of supply-side technologies performed in support of the Integrated Resource Plan by EnviroSearch:

> *The Hawaiian Heritage Program database lists some eleven listed endangered species. It also lists nine species for which the U.S. Fish and Wildlife has substantial information on biological vulnerability and threats to support a proposal to list them as endangered or threatened, and four species that are recommended as rare by a Hawaiian biologist and confirmed by the Heritage data. These listings include 15 plants and six animals (five invertebrates and one vertebrate species). A number of specific locations within the general site had observed occurrences of these species.*(3)

Field investigations (Appendix C) showed that the Kaau Crater floor is covered by three major vegetation associations. A low, wet meadow composed of the native sawgrass (*Cladium jamaicensis*), honohono (*Commelina diffusa*), and great bulrush (*Shoenoplectus lacustris*) covers most of the crater floor. On the southwestern half of the crater is a low, open scrub composed of 'ohi'a (*Metrosideros polymorpha*), strawberry guava (*Psidium cattleianum*), and hame (*Antidesma platyphyllum*). A tall, dense thicket of strawberry guava is found on the northeastern edge of the crater. The crater floor is an identified wetlands, and therefore, a "navigable waterway" under the jurisdiction of the Army Corps of Engineers.

On the lower slopes of the crater, where the proposed inlet/outlet structure would be sighted, the vegetation consists primarily of guava (*Psidium guajava*) thickets, dense clumps of ti (*Cordyline fructicosa*), and scattered patches of banana (*Musa* X *paradisiaca*).

Fauna.

A field survey of the Kaau Crater site was conducted by Dr. Leonard Freed on October 3, 1993. (See Appendix A.) No endangered, threatened, or declining bird species were seen or heard. Three endangered waterbirds have been known historically to use Kaau Crater. They are the American Coot (*Fulica americana alai*), the Black-necked Stilt (*Himantopus mexicanus knudseni*), and the Hawaiian Duck (*Anas wyvilliana*).

Eight species of the federally endangered genus *Achatinella* ("Oahu Tree Snails") historically occurred along the summit, lee slopes and windward ridge of Kaau Crater. Appendix B summarizes the historical occurrence of these snails in the area and the results of a field survey conducted on October 3, 1993. Although no endangered snails were seen during the field survey, there was sufficient surveying to confirm this finding.

An ornithological survey in 1977 revealed tadpoles and adults of the Japanese Wrinkled Frog in open pools on the crater floor, along with small gastropod mollusks and some aquatic insects.(19) The author noted that the surrounding ohia forest supported an impressive concentration of native forest birds ('Apapane, 'Amakihi) as well as exotic Japanese White-Eyes and Spotted Doves. A pair of Koloa and three Hawaiian Coots were observed in small pools within the crater. Sightings of Hawaiian Stilt by others were reported.

Water.

The USGS Topographical Map indicates the existence of wetlands in the Kaau crater. The field surveys undertaken for this report confirmed the bog-like conditions of the crater floor. The crater satisfies the Army Corps of Engineers criteria for wetland delineation.(20) It has hydric soils, hydrophytic vegetation and wetland hydrology.

A synopsis of the crater environs and a plant species list were presented in a comprehensive evaluation of Hawaii's wetlands by Elliott and Hall (21). The crater was once a lake, but encroachment of marsh vegetation completely covered the lake. Early use by Hawaiians involved fish culture in the lake, and numerous non-native plants such as banana and ti were introduced. The authors state further :

> *...The most extreme form of disturbance occurred soon after 1900 when Honolulu hydrologists built an earthen dam at the crater's only outlet, in the hopes of creating a large reservoir for city water supply. This dam, located at the northeastern corner of the crater, caused extensive flooding and destruction of native forest. Within a few years, however, the dam had partially broken and most of the reservoir waters had leaked out.*

There are perennial and intermittent streams in the Kaau Crater area, notably Waiomao Stream to the east and Pukele Stream to the west. These are both tributaries of Palolo Stream which joins Manoa Stream at the drainage channel into the Ala Wai Canal. The Palolo Tunnel drains a dike impounded aquifer several hundred feet below the crater floor and is a significant county water resource serving Palolo and Kaimuki. Flows vary from 200,000 to more than 400,000 gallons per day.(22) There is a surface flow out of the crater which eventually feeds into Waiomao Stream.

According to the *Hawaii Stream Assessment* (23), the Ala Wai Stream System of which Palolo Stream and its tributaries are a part, is rated regionally outstanding for its recreational values. Recreational opportunities throughout the system include hiking, swimming, hunting, nature study, boating, scenic views, parks and fishing. The stream

system is rated of moderate aquatic resource value, with a healthy native stream ecosystem, at least in upper reaches. Riparian resources were not highly ranked with ten percent surrounding native forest and only one threatened and endangered bird present. Cultural resources were likewise not highly ranked, but archaeological information is sparse. There is a small amount of taro cultivation downstream.

2. MAUNAWILI VALLEY

a. General Site Characteristics

The Kaau Crater Pumped Storage project would have its lower reservoir located on the windward side of the Koolaus in Maunawili Valley. Maunawili Valley is a watershed of about 18 square miles in area, which drains into Kawainui Marsh and Kailua Bay. Kawainui Marsh occupies about 1,000 acres between the 1-foot and 40-foot elevation contours. It is a lagoonal marsh, formed by a barrier beach that isolated the mouths of two large valleys from Kailua Bay.(8)

The lower reservoir site is located in the Waimanalo Forest Reserve on land owned by the State of Hawaii designated as TMK: 4-02-10:1 (Figure 8). The land is in the state Conservation District (Figure 9), designated Preservation on the County Development Plan (Figure 10), and zoned P-1. The geological characteristics are discussed in section III.

b. Significant Environmental Resources

Archaeology.

A field survey of the Maunawili Valley site was conducted on November 10, 1993 by Ms. Carol Kawachi, staff archaeologist with the State Historic Preservation Division. Her report comprises Appendix D to this report.

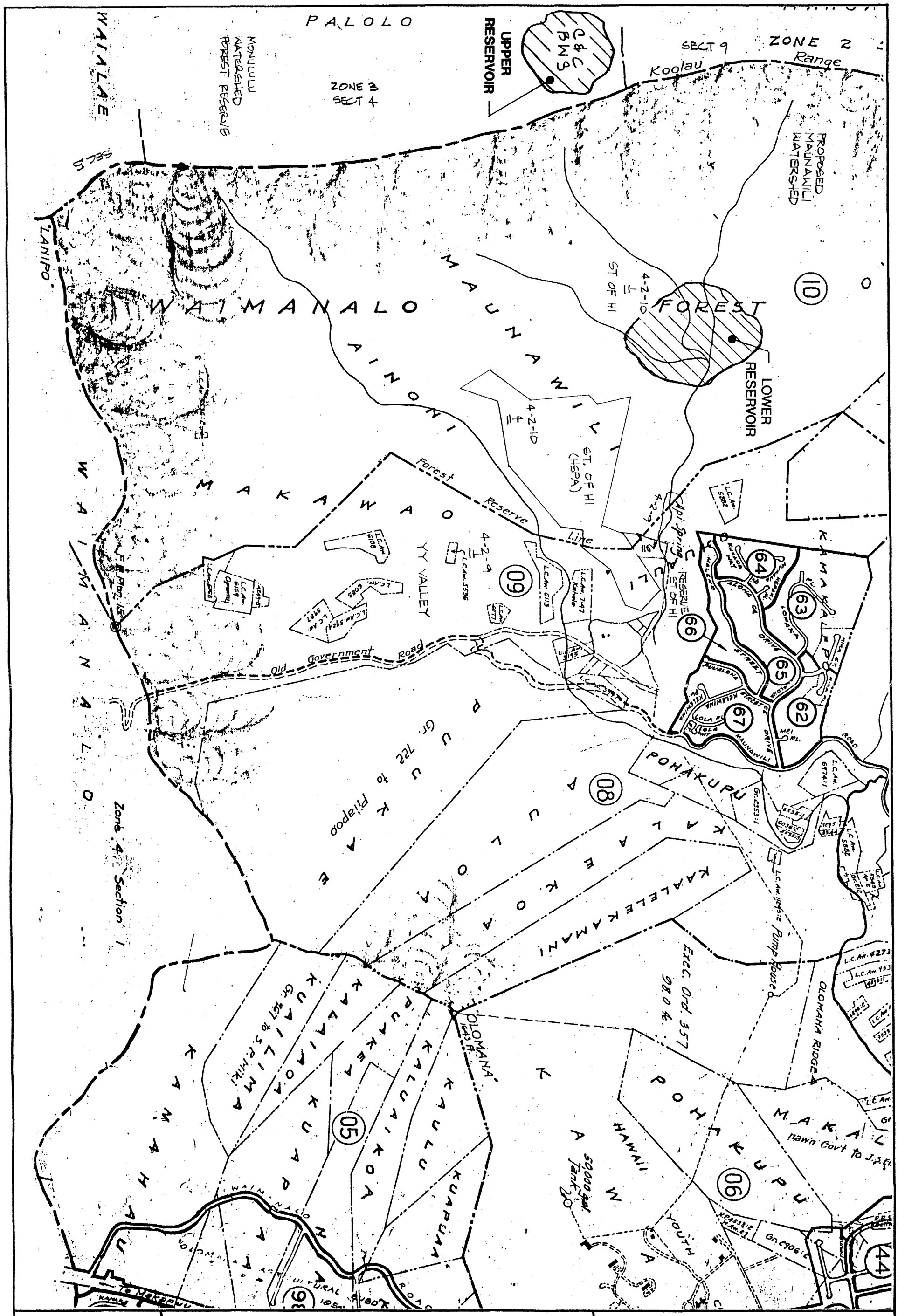
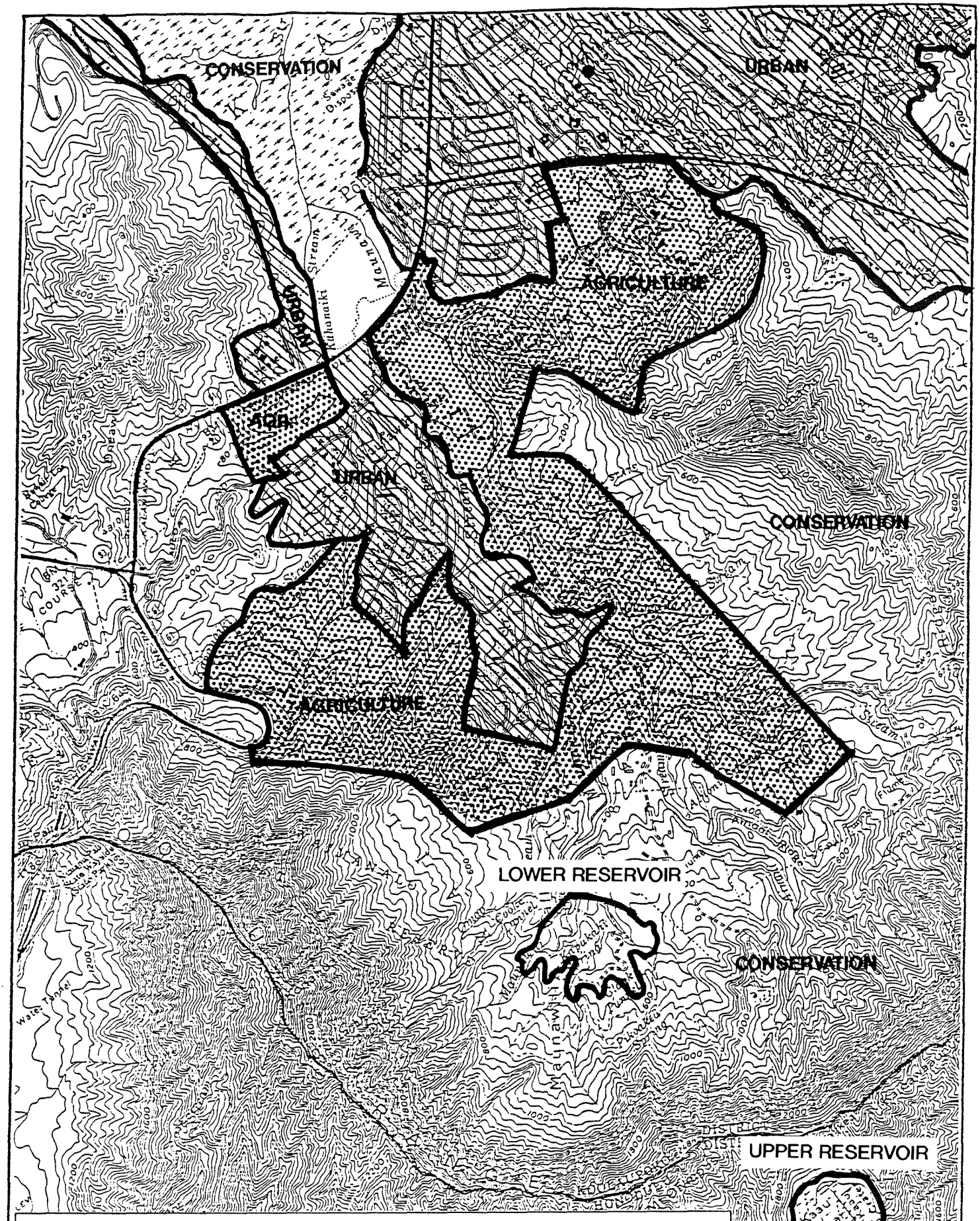


FIGURE II–8

KAAU CRATER HYDROELECTRIC PROJECT

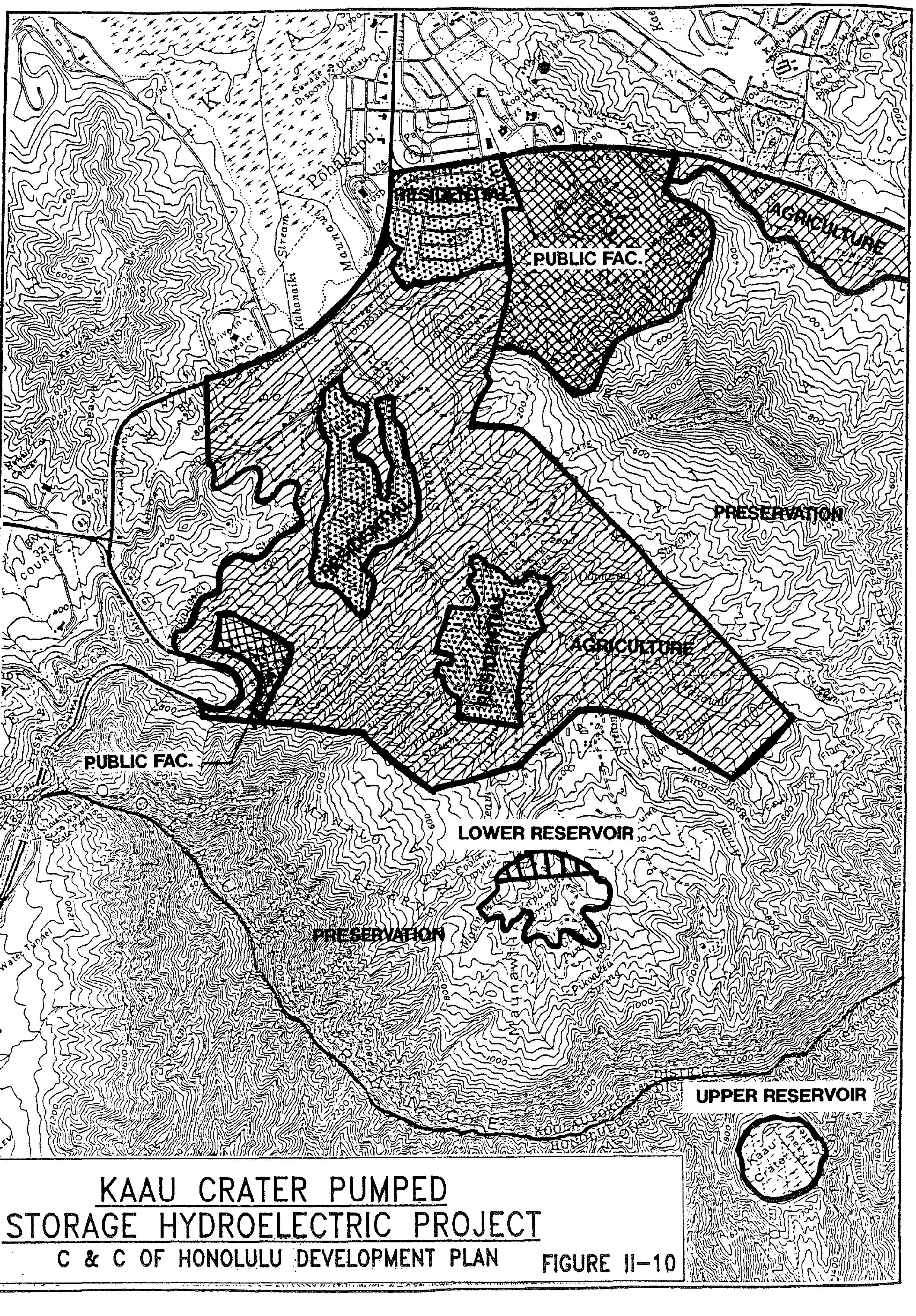
MAUNAWILI VALLEY LAND OWNERSHIP



KAAU CRATER PUMPED STORAGE HYDROELECTRIC PROJECT

STATE LAND USE BOUNDRIES

FIGURE II-9



KAAU CRATER PUMPED STORAGE HYDROELECTRIC PROJECT

C & C OF HONOLULU DEVELOPMENT PLAN

FIGURE II-10

Research in areas similar to Maunawili Valley indicates that pondfield terraces, temporary habitation structures for farmers and gatherers of forest products and religious structures could be expected. Approximately sixty percent of the project area was surveyed by the Bishop Museum in preparation for the relocation of the Luluku banana farmers. Evidence of taro pondfields and remnants of habitation sites were found. All of theses sites were mitigated.(24)

From Appendix D...

The project area is at the base of the Ko'olau Mountain Range at the back of Maunawili Valley, covering approximately 45 acres (18.2ha), and cutting across four tributaries to Maunawili Stream..., approximately 6 miles (10km) from the coast. This area was formerly Forest Reserve land which was reforested during the 1920s by the Territory of Hawaii....Small truck farms were also here between the late 1920s to the 1960s, growing banana, papaya, ginger and sweet potatoes....Vegetation, therefore, varies from areas reforested to those once under cultivation.

Since 1930, approximately twenty archaeological surveys have been reported in Maunawili Valley. Only two were done in the lower valley. The pattern in the lower valley was pondfields on the valley floor with dryland agriculture and habitation sites on the slopes.

Forty percent of the proposed project area has already undergone archaeological inventory survey...in preparation for the relocation of the Luluku banana farmers displaced by the construction of H-3....Most of the sites recorded in the narrow upper valleys were associated with agriculture, both irrigated and dryland....The pondfields or irrigated systems, near streams or springs, ranged from very small systems across rivulets to a large complex of terraces on both sides of Maunawili Stream. Dryland

agriculture fields were in the form of terraces and mounds....In some cases, both irrigated and non-irrigated fields were in the same complex....Kukapoki heiau was the only heiau identified and it overlooked a large complex of terraces along Maunawili Stream, suggesting the heiau was probably an agriculture heiau.

According to the Final EIS for the Maunawili Ditch System improvements:

The Waimanalo Irrigation System, which includes the Maunawili Ditch System, was determined to be eligible for inclusion in the National Register of Historic Places.(25)

Current Uses.

The Maunawili reservoir site is used for banana cultivation by farmers displaced from Luluku by construction of the H-3 highway. The reservoir would intersect a portion of the Maunawili Ditch System. According to a National Marine Fisheries Service representative, Maunawili Stream supports a little-known recreational Smallmouth Bass fishery.(26)

Flora.

Vegetation on the proposed reservoir site in Maunawili Valley consists of actively cultivated banana fields on the slopes and a mixed introduced forest within the gulches that cross the project site. A native plant community composed primarily of koa (*Acacia koa*) and the matted uluhe fern (*Dicranopteris linearis*) occurs on the steeper slopes behind the proposed reservoir.

Eighteen rare plants have been reported along the Koolau summit ridge high above Maunawili Valley. However, no rare plant taxa have been

reported...in...lower Maunawili Valley....Ten of the 18 rare species are candidates for federal listing, but none have been officially listed or proposed for listing.(8)

Fauna.

A field survey of the Maunawili Valley site was conducted by Dr. Leonard Freed on October 10, 1993. (See Appendix A.) No endangered, threatened, or declining bird species were seen or heard. The Short-eared Owl or Pueo (*Asio flammeus sandwichensis*), an endemic land bird, is known from Maunawili Valley. The subspecies is listed as endangered on Oahu by the State of Hawaii Department of Land and Natural Resources Division of Forestry and Wildlife. The Oahu Elepaio (*Chasiempis sandwichensis gayi*), a declining species on Oahu, has been known to occur near Maunawili Valley. The threatened Newell's Shearwater (*Puffinus newelli*) may occur in the Maunawili area. Kawainui Marsh, the largest remaining freshwater wetland in the state, provides habitat for five species of endangered waterbirds.(8)

Biological studies of the flora and fauna around the ditch and in Maunawili, Ainoni and Makawao Streams for the Ditch System Improvements EIS found no endangered or threatened species. Most of the species are exotic, although two native species (mountain shrimp, *Atya bisulcata*, and Tahitian prawn, *Macrobrachium lar*) were found in the streams. The streams are highly modified and harbor mainly introduced species. The streams are completely dewatered during low flow at the elevation of the ditch system intakes. Low flow, substantial silt deposits, large populations of the predaceous crayfish and other exotics, channelized portions of the stream bed, and only one endemic stream species result in a low biological quality ranking.(25)

...the Hawaiian continuous perennial stream community is considered rare by the Hawaii Heritage Program. This community runs through the Maunawili Valley and Kawainui Marsh, and on to the sea through the Oneawa Channel.(8)

Water.

The Maunawili Ditch System is the major source of irrigation water to the Waimanalo Watershed. Extensive repairs to the system have been made in recent years. The system is described in the Final EIS for the ditch improvements (25):

> *The Maunawili Ditch System is in conservation lands and is part of the Waimanalo Forest Reserve....Maunawili Valley is primarily drained by two perennial streams, the Maunawili and Kahanaiki Streams and their numerous tributaries. The two streams are the major contributors of flow into Kawainui Marsh, a critical wetland and Special Management Area. Average discharge into the marsh is estimated at 5.8 MGD* [million gallons per day] *from Maunawili Stream and 1.0 MGD from Kahanaiki Stream. The Maunawili Ditch System intercepts virtually all of the dry-weather flows of the Ainoni, Makawao, and East Maunawili Streams (all tributaries of Maunawili Stream) above the 440-480 ft. elevation. Other streams in the valley are unaffected by the ditch system. These include the Palapu, Omau, West Maunawili, Olomana Streams (all tributaries of Maunawili Stream) and the Kahanaiki Stream and its tributaries. The Clark, Fault, and Korean Tunnels and the Pikoakea Spring are the major dry-weather streamflow sources to the affected streams, and thus provide most of the dry-weather flow diverted by the ditch to Waimanalo....about 2.7 MGD are diverted by the five existing intakes.*
>
> *The Ditch System consists of over 16,000 ft. of lined and unlined ditches, tunnels, and elevated wooden flumes....The abandoned portion of the system formerly collected water from Omao Stream and Cooke Tunnel.*
>
> *Ground water in Maunawili Valley appears to be readily available as evidenced by the numerous springs and seeps in the area. Among the*

major springs in the valley are the Pikoakea, Omao, Kapakahi, Api, and Ainoni Springs....The major tunnel sources in Maunawili are the Cooke, Clark, Fault, and Korean Tunnels. Of the major groundwater sources in Maunawili Valley, the Maunawili Ditch System intercepts water from the Pikoakea Spring, and the Clark, Fault, and Korean Tunnels. These sources provide most of the flow diverted by the ditch to Waimanalo.

The *Hawaii Stream Assessment* (23) identifies Maunawili Stream as a candidate for protection, with a diversity of riparian, cultural and recreational resources. In particular, the cultural and riparian resources associated with the stream were of outstanding value. The overall sensitivity of the valley based on density of archaeological sites and land disturbance was high. The recreational resources were substantial; the aquatic resources were of limited value. This study considers "Kawainui/Maunawili Stream" to include Maunawili, Kahanaiki, Olomana, Omao, Ainoni, Makawao and Palapu Streams, Kawainui Marsh and the Oneawa Channel. Kawainui/Maunawili Stream is classified a "small" stream, with a median flow of 8.7 cubic feet per second (cfs). Included are wetlands, estuarine areas and recovery habitat for waterbirds.

3. KAAU CRATER PROJECT POTENTIAL IMPACTS AND MITIGATION MEASURES

a. Construction Phase

Site Work.

Site work would take place in Kaau Crater, at the mouth of the crater, along an access road up to the crater, at the lower reservoir site in Maunawili Valley, along an access road to the lower reservoir, at a switchyard, and in a 138 KV transmission line right-of-way. Tunnels would also be drilled through the Koolau Mountains connecting the upper and lower reservoirs. Site work will directly alter landforms and indirectly, would be responsible for all of the other construction phase impacts identified below.

A major landform alteration would result from construction of the dam and upper reservoir in Kaau Crater. The crater floor would be excavated, graded and compacted prior to installation of an impermeable liner. The plans assume a balance between cut and fill so that neither import nor export of soil would be required. (If a significant portion of the soil in the floor of the crater proves to be unusable as construction material, large quantities of import and export will be required). The general topography would be little altered, but the land form would eventually be obscured by the reservoir. The mouth of the crater would be dammed, altering the natural form of the crater. Grading would also be required along the access road, estimated to be 3.5 miles in length.

The same types of activities would be necessary to construct the lower reservoir in Maunawili Valley. In addition, excavation would be required for the powerhouse and tunnels. Clearing, grubbing and grading would also be necessary at the switchyard and along the route of the transmission line. (see Section III-F re: transmission lines).

In contrast to the conditions at Koko Crater, the climate at Kaau and Maunawili is considerably wetter and the topography steeper; prevention of soil erosion will be a major consideration for the contractor. Under dry conditions, dust generation could also be significant. Adherence to the City's Grading Ordinance, watering as required, and prompt paving of the access roads, would reduce dust generation. The contractor will be required to prepare an erosion control plan prior to receiving a grading permit.

Because the project would involve disturbance of more than five acres of total land area, an NPDES General Permit under DOH Chapter 55 (Hawaii Administrative Rules) for "Discharges of Storm Water Associated with Construction Activity" would be required. A second NPDES General Permit will be required for "Discharges Associated with Construction Activity Dewatering" Similarly, an NPDES General Permit will be required for "Discharges of Hydrotesting Waters" if such tests are employed.

Water Quality.

Impacts to surface and drinking water resources are of much greater concern at Kaau/Maunawili than at Koko Crater. Kaau Crater lies between two tributaries of Palolo Stream, and eroded soil particles would eventually make their way into this stream system. In addition, Kaau Crater is a drinking water source for Palolo and Kaimuki via the Palolo Tunnel. The State's general policy against water quality degradation and use interference (§11-54-01.1, HAR cited above) will be impacted by the reservoir.

The Kaau Crater/Maunawili Valley project would affect "inland, fresh" waters classified as streams (perennial and intermittent), springs and seeps, and elevated wetlands. Because both project areas are within Forest Reserves, the contained inland waters are in Class 1.a. From Chapter 54, HAR, "Water Quality Standards,":

> *It is the objective of class 1 waters that these waters remain in their natural state as nearly as possible with an absolute minimum of pollution from any human-caused source. To the extent possible, the wilderness character of these areas shall be protected. Waste discharge into these waters is prohibited. Any conduct which results in a demonstrable increase in levels of point or nonpoint source contamination in class 1 waters is prohibited;...*
>
> *The uses to be protected in class 1.a. waters are scientific and educational purposes, protection of breeding stock and baseline references from which human-caused changes can be measured, compatible recreation, aesthetic enjoyment, and other nondegrading uses which are compatible with the protection of the ecosystems associated with waters of this class;...*

The basic water quality criteria introduced in the Koko Crater sections also apply to these inland waters. Elevated wetlands have a pH criterion added, and streams have a suite of water quality parameters including nutrient and suspended solids concentrations.

In the case of Kaau Crater, the elevated wetland would be destroyed, and nonpoint source contaminants would enter stream waters during construction. In Maunawili Valley, a number of springs, seeps and streams would be covered or altered by the lower reservoir and downstream waters would receive sediments eroded during construction. While nonpoint source pollution may be controlled to acceptable levels, uses of waters covered by the development would be lost.

Land Tenure.

Kaau Crater is on lands owned by the City and County of Honolulu and controlled by the Board of Water Supply. The access road would pass over both state and city lands. The Maunawili Valley lands are owned by the state, but portions of the proposed project area are leased to the Luluku banana farmers displaced from Kaneohe by construction of the H-3 freeway. These farmers would have to be evicted again. Mitigation would involve finding suitable alternative sites and compensation for lost crops and improvements.

Recreational and Aesthetic Uses.

Construction of the upper reservoir in Kaau Crater would eliminate a destination for hikers and nature enthusiasts. Aesthetically, construction of the access road would have a greater impact than damming of the crater mouth. The access road, however, would provide easier access to the Koolau summit for hikers and hunters. While this would be a recreational benefit, it could result in the accelerated degradation of native habitat, including that of the endangered tree snails that are found along the upper elevation of the Koolau Ridge.

The Maunawili Valley project area is little used recreationally because of the restricted access maintained by the state. The area, however, is visible from the new Maunawili Demonstration Trail constructed as part of the Na Ala Hele Program of DLNR.

Views from the trail extend from the Koolaus to the ocean, and do encompass developed areas. Nevertheless, a dam, reservoir, electrical switchyard and additional power lines will degrade the wilderness character of the upper valley.

Biota.

Construction of the upper reservoir and access road would remove vegetation and habitat, including the wetland, known to be used by endangered waterbirds and snails.

The flora and fauna of the Maunawili area is not as distinguished as that of Kaau Crater, however, reduced water flows into Kawainui Marsh would affect endangered waterbird habitat.

Noise.

Development of the project sites would involve grubbing, grading, tunnel drilling, road paving, and the construction of the powerhouse and the switch yard. Construction operations can generate significant amounts of noise. Actual noise levels would depend on the methods of construction employed during each stage of the process. Earthmoving equipment such as bulldozers and diesel powered trucks would probably be the loudest equipment used during the construction. Back-up alarms, in particular, have proven especially disturbing to residents near construction sites. Because of the distance between the proposed project location and nearby residences, however, the noise from construction operations would not cause "unreasonable" or "excessive" noise as defined by "Chapter 43 - Community Noise Control for Oahu".(13) All construction equipment and on-site vehicles or devices requiring an exhaust of gas or air must be equipped with mufflers. Also, construction vehicles using trafficways will satisfy the noise level requirements adopted for Oahu for similar noise generation ("Chapter 42 - Vehicular Noise Control for Oahu").(14)

Traffic and Air Quality.

Traffic into and out of both Palolo and Maunawili Valleys would increase during construction due to delivery of equipment and materials and worker vehicles.

Short-term direct and indirect impacts to air quality could potentially occur due to project construction. There are two types of air pollutant emissions which could directly result in short-term air quality impacts during the construction phase: (1) fugitive dust (particulate matter) from vehicle movement and site excavation; and (2) exhaust emissions (primarily nitrogen oxides, but also carbon monoxide, sulfur oxides and hydrocarbons) from on-site construction equipment. Indirectly, there could also be short-term impacts from slow-moving construction equipment traveling to and from the project site and from a temporary increase in local automotive traffic caused by commuting construction workers. Carbon monoxide comprises the largest fraction of emissions from gasoline-powered vehicles.

Strict compliance with State of Hawaii Air Pollution Control Regulations (Section 11-60-5), Hawaii Administrative Rules (HAR) regarding establishment of a regular dust-watering program and covering of dirt-hauling trucks would be required to effectively mitigate fugitive dust emissions from construction activities. Twice-daily watering is estimated to reduce dust emissions by up to 50 percent. Soil transported onto paved roads by construction vehicles and activities should be promptly removed. Use of wind screens and/or limiting the area that is disturbed at any given time may be required in sensitive or dust-prone areas. Paving of designated areas, landscaping as early as possible in the construction sequencing, and rapid installation of the reservoir liner would reduce total fugitive dust emissions. Construction equipment should be properly maintained and tuned to minimize exhaust emissions (Section 11-60-4, HAR). Equipment should be shut down rather than left idling when not in use.(15)

Archaeological Resources.

Neither Kaau Crater nor the Maunawili Valley project have been surveyed adequately for archaeological resources. The sediments in Kaau Crater are of value in explaining ancient conditions and uses. In Maunawili, both habitation and agricultural sites and features could be expected in the project area. A portion of the Maunawili Ditch System, which is eligible for inclusion on the National Register of Historic Places, would be destroyed.

b. Operational Phase

Water Quality.

Unlike the Koko Crater project, the Kaau project is essentially "closed," that is, the fresh water would be recycled from lower to upper reservoir without significant discharge. Most potential water quality impacts would occur during construction while grading and perhaps through erosion of dam faces during construction.

Land Use.

Operation of industrial facilities in forest reserves may be perceived as incompatible uses. While Kaau Crater is not extensively used other than by hikers, the access road and reservoir with its attendant safety and security systems would permanently alter the wilderness character of the area.

Operation of the lower reservoir would disrupt the Maunawili Ditch System to some extent, and could alter stream flows into Kawainui Marsh. Certainly the banana farmers would have to be permanently relocated. According to the State Agriculture Plan,

Maunawili Valley does not contain "prime" agriculture lands; all of the valley is classified "other agricultural lands."

Both reservoirs would tend to increase nearby residents' fears of the consequences of natural disasters, and might negatively affect property values.

Recreational and Aesthetic Uses.

The proposed Pumped Storage facility would have recreational, aesthetic and cultural impacts. The primary impacts to recreational use would result from reduced hiking opportunities into the Kaau Crater.

Aesthetic impacts would be significant. Koolau vistas would be altered by the visual intrusion of the access road and views from the Maunawili Demonstration Trail would be altered by the new water body, and the electrical switchyard.

Biota.

Operation of the upper reservoir would unavoidably eliminate the wetlands as a waterbird habitat. This would be, in effect, filling of a wetlands. Federal regulations (Sect. 404, CWA) require that there be no practical alternative. Where avoidance or minimization of wetlands destruction cannot be achieved, compensation is required. Generally, creation or restoration of a comparable acreage is required.

Sourcing of water for this system is addressed in Section III of this report. Existing regulations insure that minimum stream flow volumes be maintained in Maunawili Stream, and sufficient water must flow into Kawainui Marsh to maintain that ecosystem.

Lights should be shielded to prevent birds from becoming disoriented.

Noise.

Noise from the PSH facility would result from operation of the pumps and generator, and to some extent from the moving water itself. The combined pump house/generating station would be below grade, thereby greatly reducing ambient noise impacts, especially at higher frequencies. There may also be some noise associated with operations of the switchyard.

Air Quality.

Air quality effects would be minimal and would primarily be associated with the incremental increase in fuel consumption at established power plant sites during the PSH pumping operations.

The project itself would have no emissions of air pollutants; it would actually result in lower islandwide emissions because of its displacement of fossil-fuel generators for peak power production. Vehicular traffic to the site would not be significant.

EMF and RI.

Electrical switching gear and transmission lines generate ambient electro-magnetic fields (EMF). There appears to be no definitive linkage of EMF and human health or ecological risks at this time. Some localized radio interference (RI) could occur around the high voltage facilities. The Kaau Crater and the area adjacent to the lower reservoir already have above ground 138 KV transmission lines.

4. SOCIOLOGICAL/POLITICAL CONSIDERATIONS

a. Housing/Infrastructure

Direct impacts to housing would be minimal. Both project areas are in Forest Reserves, at some distance from residential neighborhoods. Indirectly, there would be somewhat more traffic in adjacent neighborhoods, but infrastructure would not be unduly stressed. The existing 138 KV electrical transmission line from the Pukele substation in Palolo Valley over Kaau Crater into Maunawili Valley would be connected to the proposed switchyard and would require no acquisition of residential properties for right-of-way.

b. Residential And Neighborhood Board Concerns

On January 24, 1994, members of the Palolo Neighborhood Board were briefed on the project. Major concerns which surfaced included: the opportunity to review a draft report prior to any public hearing; the necessity for a transmission line through Palolo to the Pukele substation; the impacts of building an access road into Kaau Crater; visual impacts of an access road; loss of recreational use of Kaau Crater; and, safety in terms of both hikers and dam failure. It was suggested that enhancement of public assess along the access road would be partial mitigation of recreational losses.

On February 8, 1994, the Environmental Subcommittee of the Kailua Neighborhood Board was briefed on the project. Primary concerns expressed were replacement of the wetlands acreage in Kaau Crater, impacts to Kawainui Marsh, impacts to archaeological sites in Maunawili Valley, loss of agricultural lands and visual impacts of the facilities.

5. REGULATORY REQUIREMENTS

The project would need permits and approvals at federal, state and county levels to proceed (Table II-2). The coordinating agency at the federal level would be the Army Corps of Engineers. Filling of a wetlands would require a Corps permit under Section 404 of the Clean Water Act (33 U.S.C. 1344). The need for a federal permit would trigger additional requirements. The magnitude of potential impacts would likely trigger a federal

environmental impact statement (EIS) under the National Environmental Policy Act (NEPA).

Section 7 of the Endangered Species Act (ESA), 16 U.S.C. 1536, requires that each federal agency insure that any activity authorized, funded of carried out by it is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any critical habitat for such species. Construction and operation of the Pump Storage facility would involve modification of the physical environment as well as potential impacts on living organisms. Accordingly, review of the project for endangered species impacts will form a part of the process of granting any federal permit or authorization for the project.

The Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661-666c, requires that federal permitting agencies give full consideration to conservation of wildlife resource values in the permitting process. This consideration is accomplished through consultations between the permitting agency and the affected state wildlife agency, the U.S. Fish and Wildlife Service Regional Director and the National Marine Fisheries Service Regional Director, as appropriate. The purpose of these consultations is, to the maximum practical extent, to avoid project-caused losses of wildlife resources, to compensate for unavoidable wildlife resource losses, and to enhance wildlife resource values.(16)

The project would take place entirely within Forest Reserve lands, which are outside Hawaii's defined coastal zone. Therefore, no Coastal Zone Management Consistency Certification (Section 307(c) of the Coastal Zone Management Act of 1972 (16 U.S.C. 1456 (c)) would be required.

The State Commission on Water Resource Management has designated Windward Oahu a water management area, and is in the process of inventorying existing uses of

groundwater. No groundwater use permits are being granted until the inventory is complete.(27)

A state Water Quality Certification pursuant to Section 401 of the Clean Water Act is required by any applicant for a federal license or permit to conduct an activity in state waters that would include the construction and operation of facilities that may result in any discharge. As an emergency discharge from the facility might be required, a certification would be necessary.

Much of the proposed infrastructure for the project would be situated on lands classified Conservation by the state. Accordingly, a Conservation District Use Permit would be required from the Board of Land and Natural Resources. Use of Conservation District Lands would also trigger a state EIS under Chapter 343, HRS. Historic Site Review (Chapter 6A) would be undertaken as part of the EIS process. A revocable permit for use of state lands would be required from the Division of Land Management.

Construction of the dams and reservoirs would require permits from the BLNR. If a dam is judged to be of high hazard, an emergency preparedness plan would be required.

Because the project would involve disturbance of more than five acres of total land area, an NPDES General Permit under DOH Chapter 55 (Hawaii Administrative Rules) for "Discharges of Storm Water Associated with Construction Activity" would be required. A second NPDES General Permit will be required for "Discharges Associated with Construction Activity Dewatering" Similarly, an NPDES General Permit will be required for "Discharges of Hydrotesting Waters."

At the City and County level both discretionary and ministerial permits would be required. The Development Plan would require amendment, which may in turn trigger an

EIS requirement. A single EIS can be written to fulfill the requirements at federal, state and county levels.

A Zoning Waiver for Public Utilities may be granted by the Director of Land Utilization, and may be appropriate for the proposed project.

Ministerial permits would include a Building Permit, Certificate of Occupancy, and a Grubbing, Grading and Stockpiling Permit. The contractor will be required to prepare an erosion control plan prior to receiving a grading permit.

The permits and approvals necessary to develop the Kaau Crater site are listed in Table II-2.

TABLE 2

KAAU CRATER PERMITS AND APPROVALS

PERMIT OR APPROVAL	AGENCY OR ENTITY
Section 404 Permit (Clean Water Act)	U.S. Army Corps of Engineers (COE)
Section 7 (ESA) Consultation and Fish and Wildlife Coordination	COE with National Marine Fisheries Service (NMFS), Fish and Wildlife Service (FWS) and Hawaii Department of Land and Natural Resources (DLNR)
Environmental Impact Statement (NEPA)	COE, Office of Environmental Policy
Groundwater Use Permit	Hawaii Commission on Water Resource Management
Water Quality Certification	Hawaii Department of Health (DOH)
Conservation District Use Permit	Hawaii Board of Land and Natural Resources (BLNR)
EIS (Chapter 343, HRS)	Governor (through the Hawaii Office of Environmental Quality Control)
Historic Site Review (Chapter 6A, HRS)	DLNR, Division of Historic Preservation
Revocable Permit for Use of State Lands	DLNR, Division of Land Management
Dam Safety Approval	BLNR

NPDES Permits	DOH
Use of City Land	Honolulu City Council
Development Plan Amendment	Honolulu Department of General Planning (DGP) and Planning Commission
EIS (Chapter 25, ROH)	DLU and DGP
Zoning Waiver for Public Utilities	DLU
Building Permit	Honolulu Building Department (BD)
Certificate of Occupancy	BD
Grubbing, Grading and Stockpiling Permit	Honolulu Department of Public Works (DPW)

D. CONCLUSIONS ON PROJECT ENVIRONMENTAL AND LEGAL ISSUES

1. KOKO CRATER

- **Land Tenure** - Most of the lands to be used for the proposed project are owned by the City and County of Honolulu, and administered by the Department of Parks and Recreation, the Director of which is on the record as opposing any change in use of Koko Crater. It would likely be possible to negotiate with Bishop Estate a waiver of the existing deed restriction specifying recreational use only of Koko Crater, but monetary compensation, probably in the form of a percentage of revenues, may be required.

- **Land Use** - Existing uses of Koko Crater, including the botanical gardens and the stables could likely be relocated elsewhere. Uses of the remainder of Koko Head Park would be little impacted, except at the shoreline in the vicinity of the intake structure and breakwater.

- **Environmental Resources** - No protected native plant or animal species would be directly and significantly impacted, although Madagascan specimens in the botanical gardens and certain "exceptional trees" might be lost. Additional oceanographic, water quality and marine biological investigations would be necessary to insure that the resources of Hanauma Bay would not be impacted. Additional archaeological work would be necessary, although the extent of mitigation necessary to acquire Chapter 6E HRS. clearance is of course unknown in advance. Aesthetic impacts, especially degradation of the scenic coastal vistas, could be a significant impediment.

- **Regulatory Requirements** - Major permits would be necessary at city, state and federal levels. Justifications in terms of overall public benefits would be necessary where issues arise with respect to development plans, and special management and conservation district use areas. It is likely that a substantial list of conditions would be attached to permits, especially those concerned with the discharge waters.

- **Public Opinion** - Probably the most significant impediment to feasibility of the Koko Crater site will be public opposition. It is likely that a number of organized environmental groups would oppose the project, resulting in a long and expensive permitting process.

- **Summary** - While there are negative environmental impacts, none identified for the report appears to be insurmountable in that reasonable mitigating measures are likely to be available.

2. KAAU CRATER/MAUNAWILI RESERVOIR

- **Land Tenure** - Kaau Crater is owned by the City and County of Honolulu, and control resides with the Board of Water Supply. The Maunawili Valley project area is owned by the State, but a second relocation of the Luluku banana farmers would be necessary.

- **Land Use** - Kaau Crater is little used presently. Construction of the access road from Palolo Valley would improve recreational access to the crater, but jeopardize important habitat for protected and other native species. Construction of the lower reservoir in Maunawili Valley would likely reduce delivery of irrigation water to Waimanalo through the Maunawili Ditch System.

- **Environmental Resources** - Kaau Crater and the surrounding mountains harbor an impressive array of protected and native species. At a minimum, a unique higher elevation wetland with habitat for endangered waterbirds would be lost, and development of replacement habitat may be required as compensation. Candidate sites are not readily apparent.

  Although the biota of the Maunawili Valley site is less distinguished, the Maunawili Stream System is a candidate for preservation because of its important cultural and riparian resources. The necessity to maintain minimum stream flow into Kawainui Marsh, a major endangered waterbird habitat, and the apparent lack of significant developable groundwater resources in the valley, make sourcing of water for this project a major constraint. Archaeological and historical resources, including the Maunawili Ditch System itself, are also significant in Maunawili Valley, if not at Kaau Crater. Aesthetic impacts to both areas would be significant.

- **Regulatory Requirements** - Major permits would be necessary at city, state and federal levels. Justifications in terms of overall public benefits would be necessary where development plan and conservation district use guidelines may be violated. Windward Oahu is a designated Water Management Area, and water use plans would be subject to intense scrutiny. There is presently a moratorium on granting of new Groundwater Use Permits.

- **Public Opinion** - It could be expected that numerous environmental groups would actively oppose the project's impacts to protected species in and near Kaau Crater and the water resources of Maunawili Valley.

- **Summary** - Because of the significant negative impacts and the lack of mitigating solutions, the Kaau Crater project would appear to have very significant, if not insurmountable opposition to its becoming a reality.

E. RECOMMENDATIONS FOR FOLLOW-ON STUDIES

1. KOKO CRATER PROJECT

A full-scale inventory-level archaeological survey of the entire Koko Head Regional Park project area should be completed. The principal objectives of such an inventory-level survey would be fourfold: (a) to identify (find and locate) all sites and features present within the project area; (b) to evaluate the potential significance of all identified archaeological remains; (c) to determine the possible impacts of proposed development upon the identified remains; and (d) to define the scope of any subsequent archaeological mitigation work that might be necessary or appropriate.(4)

Required oceanographic and marine biological studies would include a species inventory, water quality measurements, analysis of facility construction and operation noise on protected species, and current measurements to determine effects of the discharge on Hanauma Bay. There should also be a survey for Pueo and prey species at the Koko Crater site.

2. KAAU CRATER/MAUNAWILI PROJECT

Before construction of the upper reservoir, a comprehensive survey for endangered tree snails near Kaau Crater should be completed. An additional bird survey for Elepaio in both Kaau Crater and Maunawili Valley should be done. Both floral and fauna surveys along the access road route should be completed.

Archaeological studies would be required in Kaau Crater and Maunawili Valley. Borings through the sediments in the crater should be taken and analyzed for information on the history and prehistory of Hawaii, in particular the composition of the native forest and its changes over time. Archaeological inventory surveys should be completed over the more than half of the Maunawili Valley project area which has not been surveyed in the past. Native Hawaiian groups should be consulted to ascertain traditional cultural values of the area.

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